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ANNUAL REPORT

OF THE

State Engineer and Surveyor

FOR THE

FISCAL YEAR ENDING SEPT. 30, 1888.

TRANSMITTED TO THE LEGISLATURE FEBRUARY, 1889

ALBANY:
THE TROY PRESS COMPANY, PRINTERS.
1889.

With Compliments of

JOHN BOGART,

State Engineer and Surveyor.

IN ASSEMBLY,

February 1, 1889.

ANNUAL REPORT

OF THE

STATE ENGINEER AND SURVEYOR.

STATE OF NEW YORK:

Office of the State Engineer and Surveyor,
Albany, N. Y., *December* 15, 1888.

To the Honorable the Speaker of the Assembly:

Sir.—I have the honor to submit herewith my Annual Report for the fiscal year ending September 30, 1888.

Very respectfully, your obedient servant,

JOHN BOGART,
State Engineer and Surveyor.

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8-25-4[illegible]

REPORT.

Office of the State Engineer and Surveyor,
Albany, N. Y., *December* 15, 1888.

To the Honorable the Legislature of the State of New York:

The State Engineer and Surveyor has the honor to submit herewith his report for the fiscal year ending September 30, 1888.

In addition to the duties devolving upon the State Engineer and Surveyor with reference to the canals of the State, and his duties as a member of the Canal Board and as one of the Commissioners of the Land Office, the Legislature has recently imposed upon that official various special responsibilities, which will be briefly alluded to in this report.

THE CANALS.

The canals were officially opened on the 10th day of May, 1888, and closed on the 1st day of December, 1888.

Navigation on the Erie canal was seriously interrupted by a formidable break, which occurred near the village of Adams Basin, about fifteen miles west of Rochester, on the long level of sixty-two and one-half miles. The repairs were completed and navigation resumed in twelve days. No other serious breaks have occurred on the Erie canal, and but one causing any great detention on the Champlain canal.

The total freight moved upon the canals of the State during the season of navigation of 1888 amounted to 4,492,948 tons.

The general condition of the canals is steadily improving, in consequence both of the judicious application of the special extraordinary appropriations made by the legislature for particular improvements, and also of the systematic expenditure of the funds available for repairs. In the opinion of the State Engineer and Surveyor, these expenditures have been made by the Superintendent of Public Works to the best advantage. The experience and good judgment of that official are notable and of special value. Every endeavor has been made by the State Engineer and Surveyor's department to aid his efforts to secure the best results.

ORGANIZATION OF THE DEPARTMENT.

The organization of the department has been substantially the same as in previous years. Mr. A. S. C. Wurtele has been the Deputy State Engineer and Surveyor, and the division engineers in charge of the respective divisions have been: On the eastern division, Mr. Chapman L. Johnson; on the middle division, Mr. Dennison Richmond, and on the western division, Mr. Thomas Evershed. The resident engineers have been: On the eastern division, Mr. John P. Kelley; on the middle, Mr. Henry T. Beach, and on the western, Mr. John Bisgood. Mr. John R. Kaley was division engineer of the eastern division, and Mr. Chapman L. Johnson, resident engineer, up to January,1888.

Reference is made to the reports of the Division Engineers for important details and valuable suggestions.

LENGTHENING OF LOCKS.

One of the chambers of the lock at Geddes, No. 50 of the Erie canal, was lengthened in the spring of 1885, as an experiment. This was done because, in the navigation of the canals, the use of two boats fastened together, the one behind the other, had become frequent. This was the case both with boats drawn by animal power and with boats propelled by steam. Delay in locking such boats was considerable on account of the necessity of separating the two boats before entering the locks and of again fastening them together upon leaving the locks. The result of the experiment was so satisfactory that the Legislature, the next year, authorized the lengthening of five additional locks on the Erie canal and three on the Oswego; these were completed in the spring of 1887. The next Legislature authorized the lengthening of sixteen additional locks on the Erie canal and two on the Oswego canal. The work of lengthening one of these on the Erie canal, No. 46, has not been done on account of an injunction secured by the Delaware and Lackawanna Railroad Company, whose track crosses the canal by a swing-bridge directly below the lock, and must either be raised or lifted in order to carry out the improvement in a proper manner. The work of lengthening these fifteen locks, and also the work of lengthening the two locks on the Oswego, was finished in the spring of the past year, 1888, and final estimates have been made by this department.

The last Legislature made an appropriation for the continuance of this work, and as directed by the law the Superintendent of Public Works and the State Engineer and Surveyor have selected certain additional locks to be lengthened, viz.: Nos. 26, 27, 28, 29, 30, 63 and 64 of the Erie canal. Advertisement was duly made and bids received for these, but the amount of the bids was too great to permit all to be constructed within the amount appropriated, and therefore the contracts for Nos. 27, 28, 29, 30, 63 and 64 have been awarded and work upon them has been commenced. Nothing has been done upon lock No. 26. In the same manner lock No. 11 and guard lock No. 3 of the Oswego canal were selected, and work upon them is now in progress. The work upon all of these locks will doubtless be completed by the opening of navigation in the spring of 1889.

On completion of lock lengthening now under contract the long stretches of canal for double-headers next season will be as follows:

ERIE.

	Lock.	Miles.
Three miles east of Port Jackson to Little Falls..	26 to 36	43.50
Mohawk to Utica........	43 to 46	14.02
Utica to Newark........	46 to 57	113.76
Newark to Brighton........	59 to 65	33.89
Brighton to Lockport........	66 to 67	62.49
Lockport to Buffalo........	71 to city.	31.56
Total........		299.22

OSWEGO.

	Lock.	Miles.
Salina to Fulton........	3 to 8	24.06
Fulton to Minetts........	10 to 12	5.66
Total........		29.72

	Miles
Being an increase over 1888 on Erie of........	9.02
Being an increase over 1888 on Oswego of........	1.81
Total increase over 1888........	10.83

FUTURE WORK.

The lengthening of lock No. 46 would give one continuous stretch of improved canal of 127.78 miles from Mohawk to Newark. The lengthing also of the two remaining locks at Brighton, Nos. 65 and 66, would give another long stretch of improved navigation of 97.43 miles from Newark to Lockport. The lengthening of the three Newark locks, Nos. 57, 58 and 59, would connect the last mentioned two long stretches and give a continuous improved canal of 255.55 miles from Mohawk to Lockport.

NEWARK LOCKS.

The three Newark locks, Nos. 57, 58, 59, are of eight feet lift each and could be changed into two locks of twelve feet lift each.

In 1863, W. B. Taylor, then State Engineer and Surveyor, made plans for a change in location of canal at Newark on north side, with about three-quarters of a mile of new canal, with two combined locks to replace the present three locks. The cost of this work was estimated at $228,614, for single locks 225x26 feet 10 inches, at prices not far from present contract prices. It would be very advantageous to make the change from three to two locks, and the new location would give good results and not a very large excess of cost above lengthening the three locks, especially as the work could be completed in summer when the cost of transportation is at a minimum and result of labor at a maximum. For the three-quarters of a mile of canal and two double locks, 220 feet long by twenty feet wide, an approximate estimate would be $300,000.

IMPROVING THE CHANNEL OF THE CANALS.

As far as funds have been available the channel of the canals has been improved by the removal of material deposited during the course of years. The continuance of the removal of such material is of great importance, and further appropriations devoted to this purpose will essentially improve canal navigation.

More than thirty years ago a timber and plank docking was constructed at certain portions of the Erie canal in place of the original slope wall. The upper portions of these timber works have failed and have given considerable annoyance in the maintenance of the canal for several years past, and a provision should be made directly for a proper repair.

A number of bridge abutments on the berme side of the canal have yielded to the pressure of the embankment in the approach and the tops have moved toward the canal so that there has been danger of their falling entirely. In several instances these have been successfully restored to their proper position by digging behind them and partially under the rear portion and forcing them back to their normal position without break or injury to the masonry.

On the Erie canal, cross-sections are now being taken on the middle and western division to determine the work to be done in order to bring the canal to its original section. The excavation will generally be light and concentrated along the sides at the foot of the slope walls, so that it will be expensive to do by contract, besides the danger that, by inattention, contractors may undermine the slope walls. It could be done much more advantageously by the regular section superintendents without contracts. The attention of the Legislature is called to the conditions which render the execution of this work by contract, disadvantageous and expensive.

THE CHAMPLAIN CANAL.

The Champlain canal was improved by widening and building vertical walls in the worst places, for a distance altogether of 2.42 miles, and a further length of 3.02 miles is now under contract, the narrowest places being chosen for improvement.

This work is of great importance, as in many places the Champlain canal is too narrow for two boats to pass, and great benefit has been evident from the work already done.

THE BLACK RIVER CANAL.

This canal requires considerable attention and improvement to keep it in navigable order. The locks Nos. 8 and 48 of this canal, have been rebuilt during the past season, and under the appropriation made by the last Legislature lock No. 60 has been selected for rebuilding, and work upon it is now in progress, to be completed before the opening of navigation in the spring of 1889.

A number of the locks between Rome and Boonville are in bad condition, while those north of Boonville are in fair condition, with the exception of one, No. 76, which has settled badly and will probably soon have to be rebuilt. The supply of water to this canal, and through it to the Erie canal, is treated of in another portion of this report.

WATER SUPPLY FOR THE CANALS.

The navigation of the canals depends absolutely upon a constant supply of water, and this supply should be capable of regulation in such a way as to secure at all parts of the canals the water required at any moment. It is, therefore, of primary importance that the arrangements for assuring such a supply should be maintained in perfect working condition, so that the Superintendent of Public Works may be able to store water or deliver it into the canals as may be demanded by the constantly varying requirements of navigation, depending upon the number of lockages, the rainfall, and such incidental contingencies as may from time to time arise.

The provisions for the supply of water to all parts of the State canals are described fully in the reports of the several division engineers presented with this report.

WATER SUPPLY ON THE EASTERN DIVISION.

The western nineteen miles of the eastern division, west of Little Falls, is supplied from the middle division. At Little Falls a supply is received from the Mohawk river, by means of a dam across the river at that point. This dam is a timber structure, now in a very bad condition, through which a large amount of water constantly leaks, the result of which is a much larger draught on the supply from the middle division than should be made. A good dam at Little Falls is essential to the best working of the canal, and the old structure should be taken down and a new stone dam be built. The estimated cost is $15,000.

The water supply on the other portions of the eastern division of the Erie canal does not demand attention at present.

WATER SUPPLY ON THE MIDDLE DIVISION.

The supply of water for the central portion of the Erie canal is to a large extent secured from the head waters of the Black river, passing from the pond at Forestport through the feeder to Boonville, and thence by the Black River canal to the Erie canal at Rome. It is necessary that this supply should be constantly maintained, as it feeds the central summit level, and on it depends largely the navigation of the canal from Rome westwardly to Syracuse, and eastwardly to where the supply from the Mohawk enters at Little Falls.

Representations have been made that the manufacturing interests along the Black river suffer severely from the diversion of this water to the canal, which naturally would and formerly did flow down the valley of the Black river.

The Senate of the State has requested from the State Engineer and Surveyor a report on this subject, and during the past season he has made a careful investigation of the history of this water supply and has made a personal examination of the head waters of the Black river and various streams and lakes from which its supply is drawn. He has also had surveys and expert examinations made as to points which would aid in determining questions which arose in the study of the problems connected with this matter.

The construction of the Black River canal was provided for by chapter 157 of the Laws of 1836. One of the provisions of that law was "that the feeder and canal shall be so constructed as to pass as large a quantity of water to the Erie canal as can reasonably be spared from the Black river and from the northern portion of the Black River canal." The act also provided that payment should be made "towards the construction of said canal and feeder, of such sum as the Canal Board shall estimate and certify would be the probable expense of a feeder from the Black river to the Erie canal sufficient to supply the additional water that will be required on the Rome level."

The dam at Forestport, (then called Williamsville), which diverts the waters of the Black river to the Erie canal was not built till 1848, and the feeder was opened regularly for use on July 4, 1849.

The feeder extends from this dam at Forestport ten miles to Boonville, where it enters the summit level of the Black River canal. Thence its waters flow both southerly to the Erie canal at Rome and northerly through the Black River canal to where that canal enters the Black river at Lyons' Falls. It will be seen that such portion of the water as flows northerly is restored to the Black river at Lyons' Falls, whence to Carthage navigation is maintained on the river by means of jetties, locks and dams.

The feeder is estimated to carry 16,000 cubic feet per minute from the Forestport pond to Boonville. Careful measurements have been made and past records examined in regard to the amount returned to the Black river, and this amount the State Engineer and Surveyor now places at an average of 5,000 cubic feet per minute. The diversion to the Erie canal is placed, therefore, at 11,000 cubic feet per minute.

When the water was first diverted in 1849, claims were made upon the Canal Commissioners for damages, and for several years the Canal Commissioners took the ground that the appropriation of the water was only temporary, and they allowed damages on that basis to various parties between Forestport and Lyons' Falls. In 1854 the Auditor refused to pay one of the drafts given by the Canal Commissioners in payment of such a claim. The Auditor maintained that the appropriation of water was permanent, and that the Canal Commissioners had no authority to settle such claims. The case was presented to the Supreme Court and then carried to the Court of Appeals, which court sustained the position of the Auditor.

Those interested then filed claims for permanent damage, and these claims, about sixty-two in number, aggregating over $600,000, and extending from Forestport to the mouth of the Black river, were presented to the canal appraisers. Hearings continued from July to December, 1858. These numerous claims being quite similar in their nature, two were agreed upon as representing the whole, and mutual stipulations were made, by consent of all parties, that all testimony taken in the several claims might be used as such in all. One of these claims was that of the Black River Woolen Company of Watertown, and the other that of Platt Williams at Forestport; these representing the situation at different parts of the river. The testimony is given in the reports of the Canal Appraisers. The awards of the appraisers give a very full history of the whole subject, including the construction of the feeder, the diversion of water, and its effect, and the steps taken by the Legislature for the relief of owners of water powers. In 1850, Mr. D. C. Jenne, resident engineer, made, under instructions of the Canal Board, a report in which he said: "Unless an amount of water be returned to the Black river, equal to the quantity thus diverted, heavy damages to water power will ensue, the amount of which will be almost incalculable."

Based upon this report the Legislature passed an act, chapter 181, Laws of 1851, providing for the construction of reservoirs. The Canal Commissioners were required by this act "to create, if practicable, reservoirs of sufficient capacity to supply the Black River Canal feeder with such quantity of water during the summer months as shall be necessary for the supply of the Black River and Erie Canals, and as shall give to the Black river, as near as may be, as much water as ordinarily flows therein during the summer months." The act also provides that "the waters from said reservoirs shall be discharged so that the waters so reserved shall be let into the Black river during the summer months in such manner and in such quantity as to give, as far as practicable, to the inhabitants residing on said river the benefit of said reserved waters when the same shall be required for use, and such supply shall not be less than the quantity which ordinarily flows in said river during the summer, provided the supply from said reservoirs will furnish such quantity after supplying the Black River canal and the Erie canal with water."

The construction of dams to make effective some of the proposed reservoirs above Forestport was begun, and work on them proceeded as legislative appropriations were made, but in 1858, when the appraisers were considering the claims above referred to, only the North Branch reservoir had been completed. Work had been begun on South Branch, Woodhull and Chub Lake reservoirs, but had been stopped in 1857 for lack of funds.

The appraisers state " that for the nearly four years that the present Board of Appraisers has held office they have kept these claimants at bay in the hope that a time would come when they could dispose of their claims in a manner that at least would be satisfactory to themselves. * * * It is unreasonable to ask the claimants to wait an indefinite number of years more. The State has permanently appropriated this water. * * * If the reservoirs were completed, it is questionable whether they would wholly restore the original state of things. * * * While we can not ignore the fact that the State has had in contemplation the erection of reservoirs, and may yet complete them, and the water be restored, we can only take these things into account in a qualified and limited sense."

The appraisers made their awards, based upon the above and other considerations.

The Canal Commissioners appealed from the awards in a number of cases to the Canal Board.

The Canal Board, February 10, 1860, decided the appeals. In the decision the Canal Board said: "Whereas, in the opinion of this board the said appraisers in making their award of damages did not take into consideration the full amount and flow of water to be obtained and supplied to the said river and feeders by the construction and maintenance of the reservoirs designed to limit the use of the water of said river by the State as contemplated by the act of 1836 and which reservoirs were in process of construction and will soon be completed so as to supply a quantity of water nearly adequate to the wants of the State, as now contemplated, and thus return to the claimants the water of which they otherwise would have been deprived; therefore, Resolved, That the awards of the Canal Appraisers in the twenty-two cases stated below, * * * be reduced to the sums fixed and stated, * * * the rate of reduction being 35 per cent on the amount of each award of the appraisers."

It will be seen that the awards of the Canal Appraisers in these Black river cases were reduced by the Canal Board on the ground that the appraisers did not take into consideration the full amount and flow of water to be obtained and supplied to the Black river and feeders by the construction and maintenance of the reservoirs, the construction of which was contemplated by the State.

Since that time reservoirs have been built which have a storage capacity apparently sufficient to supply the full amount diverted to the Erie canal during the dry season, which diversion affects seriously the mill properties in that valley. I refer now to the reservoirs constructed above Forestport, the waters from which can be sent through the feeder to the Black River and Erie canal; the portion of which not required for the Erie canal would go to the Black River, either directly at Forestport, or through the canal northerly from Boonville.

But for various reasons, to be referred to hereafter, the construction of these reservoirs has not supplied the water needed. This fact has been recognized by the State and the Legislature has endeavored to provide for the deficiency by the construction of two dams upon the Fulton chain of lakes, the waters of which pass through the Moose to the Black river; and also by one dam at Stillwater on the Beaver river, the waters from which pass through that river to the Black river. Neither of these reservoirs on the Fulton and Beaver rivers can supply any water to the Erie canal; all the water stored by them must go to the valley of the Black river.

The actual storage capacity of all the reservoirs combined is very large, but evidence, which seems to be conclusive, has been given that there still exists a great lack of water supply during the dry season along the valley of the Black river.

The reasons why the large storage capacity of the various reservoirs has not been sufficient to provide a greater dry weather flow, are stated in detail in the report of Mr. A. S. Kibbe, the assistant engineer in charge of the examinations made under my direction during the past summer. These reasons are, in short, the inaccessibility of the large impounded lakes at the head of the Black river and Moose river, their distances from each other, and the constant use of the water surreptitiously, by lumbermen, for the purpose of floating logs down the streams. The funds at the disposal of the Superintendent of Public Works are not large enough for the employment of sufficient guards to prevent this surreptitious use of the water. The fact is that the water is constantly drawn from these reservoirs in the woods at times when it is not needed either for the canals or for the manufacturing interests on the Black river. This water flows through the river, flows over the dam at Forestport, and is lost from the impounding reservoirs.

In 1883, the Legislature authorized the construction of an additional dam and reservoir at Forestport, but appropriated therefor only $20,000; the engineer's estimate for the construction of a proper dam being $55,000. Stone was quarried and cut, and some excavation made at the site of the dam, but the amount available being entirely too small, work has been abandoned for four years. The Legislature, in 1881, made an appropriation for a reservoir on the Beaver river, which was supplemented by acts passed in 1882, 1884 and 1886, and under this latter act the Stillwater dam was erected on the Beaver river, with an available height of nine feet one inch.

The locations chosen for these two dams and reservoirs, that is to say, the one at Forestport on the Black river, and at Stillwater on the Beaver river, are in harmony with what the State Engineer and Surveyor believes to be the best method of securing a storage of water which will be available to the best uses for which storage is desired. That is to say, the true principle is to build reservoirs of very large size, as far down the course of the rivers as is practicable with regard to suitable construction, and to lead into such reservoirs all the flow from above them. Then the outflow can be guarded and controlled by suitable superintendence, and the flow required, either for the canals or for the mill properties, can be maintained so as not to run below a fixed rate throughout the year.

The construction of a dam and reservoir of proper size at Forestport would insure to the Erie canal at Rome, and to the Black River canal at Boonville, a constant and ample supply of water, and would also give to the Black river, from Forestport to Lyons Falls, an available surplus beyond what would be required for canal purposes.

The dam and reservoir already built at Stillwater have done good service, but the dam can, at no great cost, be considerably raised and the reservoir materially enlarged, and this would impound at one point the waters of a very large watershed, the outflow of which could also be properly controlled so that a minimum regular flow could be maintained. It is the opinion of the State Engineer and Surveyor, and he recommends, that both these works should be undertaken.

The original plan of the dam at Forestport was for a structure of twenty-one feet in height. The plan was modified to one of fifteen feet in height, but the State Engineer and Surveyor considers the original height much more desirable. The 15-foot dam would enclose in its flow-line about 800 acres, but a large part of that area would be covered with but a very small depth of water. The additional elevation of six feet would not increase the area of the overflow to any great extent, but would very greatly enlarge the storage capacity, which at this point is of very great value. This dam would be near the upper end of the present feeder, immediately under the control of the superintendent. It would have a capacity of at least 350,000,000 cubic feet of water. An appropriation should be made for this of $60,000.

This water would insure an excellent supply for the canal, and, in the opinion of the State Engineer and Surveyor, it would add considerably to the minimum flow in the river also.

It is also recommended that the Legislature authorize that such steps should be taken as may be necessary to control the flow of water through Chubb lake. This is one of the lakes authorized to be dammed in 1855 but the State never completed a dam upon it. There is, at the foot of the lake, a timber dam, controlled and kept in repair by private parties. The entire flow of Woodhull lake, Sand lake and the Bisby lakes passes through Chubb lake, but this flow is frequently stopped by the persons controlling this private timber dam, with the result of preventing the water from coming to Forestport and to the feeder when it is often most urgently needed. This dam should either be secured by the State, or, what is perhaps as well, it should be destroyed, so that the water from the upper lakes can pass through Chubb lake to Forestport without being held in its course.

The Stillwater dam on the Beaver river has now an available height, as has been stated, of 9 feet 1 inch. It is a good structure of timber, about 350 feet long. The present capacity of the reservoir is estimated at about 328,000,000 cubic feet. Every foot added to the present height of the dam will increase the present capacity 100,000,000 cubic feet. It has been found by lines of leveling that the present dam can be raised considerably, without danger of overflowing through other outlets.

In the opinion of the State Engineer and Surveyor, it is desirable to raise this dam about eight feet higher than its present elevation. The reasons for this opinion are, that the present dam has overflowed a very large area and that upon this area considerable timber has been killed by the overflow of the water. Much of the area is overflowed at present but very slightly when the reservoir is full. When the water is required for increasing the flow in the Black river, the drawing down of the present reservoir lays bare much of this flowed area and the exposure thus made does not add to the healthfulness of the country. If the dam were raised, as herein suggested, a very large proportionate increase in its capacity would be effected, and in using the water it would not be necessary to expose these wide areas of overflowed land. For the larger portion of the overflowed area the additional height would be upon the steeper side hills surrounding the reservoir and the capacity of the dam would thus be increased without greatly increasing the area of the overflowed land.

It has been suggested that other points upon the Beaver river might be advantageously used for reservoirs, and Smith's lake, which is some distance above the Stillwater reservoir, has been particularly indicated. A careful examination of that lake was made by the State Engineer and Surveyor and his assistants during the past season, and it was found entirely practicable to build a dam there which would impound a considerable amount of water, but the expense of such a dam would be as great as is the addition suggested to the height of the Stillwater dam. It would require additional supervision; there is no access to it except by boat and carry; it would not have the capacity of the addition proposed to the Stillwater dam, and all the water from its water-shed flows down the Beaver river to the Stillwater reservoir. The raising of the water on the shores of Smith's lake would destroy the beauty and healthfulness of one of the most charming lakes of the Adirondacks and would probably entail a large amount of claims for damage against the State.

The State Engineer and Surveyor therefore recommends that the Legislature authorize the increase of the height of the Stillwater dam by at least eight feet in addition to its present height; the estimated cost of which is $25,000.

Attention is called to the full report of Mr. A. S. Kibbe, the assistant engineer in charge of the examinations of this subject under the direction of the State Engineer and Surveyor.

The supply of water upon the Jordan summit level has been equal to the demand since the construction of the Otisco Lake reservoir.

Attention is especially called to the recommendations as to the water supply of the middle division in the report of Mr. Henry T. Beach, acting division engineer, submitted herewith, particularly with reference to the Kingsley Brook dam; the extension of the pipes and a provision of a proper valve-house at the Kingsley Brook reservoir; the improvement of the channel below the Jamesville reservoir, and the enlargement of the valves in the Oswego canal guard locks.

WATER SUPPLY ON THE WESTERN DIVISION.

The chief source of supply of water for the western division is Lake Erie, and the flow from the lake is continuous towards the east. The waters from Tonawanda and Oak Orchard feeders, and from the Genesee river are of great value in filling the canal in the spring.

At the time of the break, in July last, a short distance west of Rochester, at the long level of the canal, the supply from the Genesee river was of special value, and this fact leads to the suggestion that it will be desirable that this source of supply be guarded and maintained. In the early history of the canal, before the prism was completed to its full area through the heavy rock cut west of Lockport, the Genesee river supply was depended upon as an essential element in the maintenance of navigation east of Rochester. In case of any serious accident west of Rochester this supply, immediately available, would be of great value.

It is understood that the city of Rochester, or those interested in the water power at that place, have under consideration measures for storing the waters of the Genesee river above Rochester. The State will have a special interest in the study of this subject and must reserve, in the opinion of the State Engineer and Surveyor, all privileges which it possesses and which are essential to the use of the water for the canals, at the same time not preventing a proper use and regulation of any surplus.

WATER SUPPLY FOR THE CHAMPLAIN CANAL.

The principal water supply for the Champlain canal is received through the Glens Falls feeder. This feeder for some distance in the vicinity of Glens Falls is constructed through a rock formation of very open natural stratification, and which is full of fissures in the strata. Observations of the flow through this feeder, made last year, showed a loss of about fifty per cent of the water. Some good wall has been built during the past season, but the funds available did not permit any repairs to the bottom, and only a small proportion of the leakage has been stopped.

At the last session of the Legislature a special appropriation was made to be expended upon this feeder, the amount, however, being not enough to complete the repairs very immediately necessary. Under the provisions of chapter 416 of the Laws of 1888, it has been determined to expend a portion of the sum thereby appropriated for the Champlain canal, to the repair of this feeder upon plans determined upon in consultation of the Superintendent of Public Works and the State Engineer and Surveyor.

There can be no question of the expediency and ultimate economy of doing whatever work is undertaken on this feeder in a thorough manner, so as to effectually stop this enormous leakage of water. The amount now available will be sufficient to extend this work over only a portion of that part of the feeder where these serious leaks exist. It is desirable that a sufficient further appropriation be made for this purpose.

The feeder itself carries an extensive and important commerce, and this is greatly impeded and hindered by the effects of the leakage referred to, so that the repairs described become of greater necessity even than if the feeder was used only for its water supply.

LIFT-BRIDGES.

Five lift-bridges were completed during the past year and are now in operation, and special legislation calls for five more. The attention of the Legislature is called to the constant stoppage of street traffic when these bridges are raised at very short intervals, as must be the case during the busy season of navigation on the canals. The operating expenses of these bridges are considerable, and must be borne by the citizens of the locality where they are placed. They are delicate mechanical structures, liable to be struck by boats, should any delay in raising them occur from the inattention or carelessness of employés, or from any accident to their machinery. One, at Clyde, was badly injured and twisted by a tornado. There is danger that they will be a constant annoyance and expense to the State in the future. The State Engineer and Surveyor recommends that no additional lift-bridges be authorized, unless a very clear necessity exists for their construction in special and isolated cases, and each application for the construction of such a bridge should be examined with great care.

Power, either from the water mains of towns, or by a turbine where the location permitted, has, in several cases, been substituted for the method of raising and lowering these bridges by hand-power. It is a great improvement and should be adopted wherever possible.

BREAKS.

The most serious break which has occurred during the past season was near Adams Basin, about fifteen miles west of Rochester. It happened on July 8, 1888. It was at the point where a double arch culvert carries Little Salmon river under the Erie canal. The water carried away a high bank making an opening of some sixty feet in length and taking out the material to a depth of twelve feet below canal bottom. It also destroyed the waste-weir and spill-way on the bank over the culvert and carried away a part of the culvert itself. The repairs were completed on July twentieth. Work was carried on day and night, some 5,000 cubic yards of material being filled in with the addition of about 1,000 cubic yards of clay for puddling which had to be hauled a distance of one mile, that being the nearest point at which it could be found. There were also used in the repair of this break 30,000 feet, board measure, of lumber, and 100 cubic yards of masonry, and fifty cubic yards of dry wall were built. The work was delayed by a leak which developed in a bed of quicksand at the east end of the timber crib which had been put in place and which entailed the use of sheet piling eighteen feet below canal bottom.

Another break occurred near Brighton, July twenty-seventh, which was repaired in one day. On the Champlain canal three leaks occurred during the year, and one at Lock 3 of the Glens Falls feeder. Navigation was interrupted by the most serious one for five days.

HUDSON RIVER IMPROVEMENT.

Under the provisions of the act to improve the Hudson river between Troy and Coxsackie, a large amount of work has been done by the Superintendent of Public Works, amounting to 195,414$\frac{1}{10}$ cubic yards of material dredged and removed from the channel of the river. The engineering connected with this work has been in charge of a small corps, under the direction of the State Engineer and Surveyor. The report of Mr. Martin Schenck, the assistant engineer in charge, gives the details of this work. The dykes erected a number of years ago by the United States government, are in many places in need of immediate repair. The expenditure by the general government of a comparatively moderate amount in the repair of these dykes, would prevent the necessity for their entire renewal, which will certainly otherwise become necessary very soon, and would also greatly lessen the formation of the bars, on the removal of which the State annually has to expend a large amount of money.

TABLE SHOWING APPROPRIATIONS BY THE STATE OF NEW YORK FOR IMPROVING THE NAVIGATION OF THE HUDSON RIVER FROM 1797 TO 1888.

Year.	Chapter.	Amount appropriated by State.
1797	39	$7,500 00
1799	20	3,750 00
1800	25	28,000 00
1801	68	10,000 00
1801	8	5,000 00
1803	68	7,500 00
1804	67	20,000 00
1810	133	30,000 00
1811	188	15,000 00
1812	157	19,852 66
1813	185	7,000 00
1827	296	21,000 00
1829	374	1,000 00
1840	95	500 00
1849	406	10,000 00
1852	365	10,000 00
1857	374	25,000 00
1858	361	1,000 00
1863	122	100,000 00
1864	105	134,326 63
1865	561	125,000 00
1866	491	150,000 00
1867	647	150,000 00
1872	346	50,000 00
1873	713	50,000 00
1876	204	40,000 00
1877	412	15,000 00
1878	205	30,000 00
1879	106	30,000 00
1880	51	30,000 00
1881	230	30,000 00
1882	372	30,000 00
1883	451	30,000 00
1884	110	30,000 00
1885	210	30,000 00
1886	172	25,000 00
1887	162	30,000 00
1888	173	50,000 00
		$1,381,429 29

THE ALBANY BASIN.

The work of dredging the Albany basin, specially directed by the Legislature, has been in progress under contract.

SURVEYS FOR THE USE OF THE ATTORNEY-GENERAL IN CASES OF CLAIMS FOR DAMAGES.

These surveys are of the utmost importance. The Legislature of the past year recognized this fact and appropriated in the law providing for expenses connected with the canal claims before the Board of Claims, the sum of $5,000 for such surveys. This action has made it possible to provide for these surveys when required by the Attorney-General, and the information thus obtained is of such value that an appropriation of the same amount is recommended for the ensuing year.

IMPROVEMENTS AT THE QUARANTINE ESTABLISHMENT OF THE PORT OF NEW YORK.

Under the provisions of chapter 270, Laws of 1888, the State Engineer and Surveyor is made a member of the Board of Commissioners, with the Mayor of the city of New York, the Mayor of the city of Brooklyn, the Quarantine Commissioner and the Health Officer of the port of New York, which commission is entrusted with the supervision of repairs and improvements in the quarantine establishment of the port; for which purposes an appropriation of $224,343.00 was made.

The condition of the structures connected with the quarantine establishment, and of the quarantine islands in the lower bay was found to be such as to demand very careful adjustment of the expenditure of this money, and the commission has called upon the State Engineer and Surveyor for constant and continued counsel and advice during the past season. Work under this appropriation is steadily in progress.

THE CAPITOL PARK.

Under a special enactment, the State Engineer and Surveyor prepared a design with specifications, for the improvement of the Capitol park in the city of Albany. Broad walks upon graceful lines and with easy grades were designed to conduct passage in either direction through the park, and the surfaces were to be graded and sodded in a simple, but effective manner. This work has been completed.

THE CEILING OF THE ASSEMBLY CHAMBER.

At the request of the Legislature, the State Engineer and Surveyor examined, together with Messrs. Thomas C. Clarke and Richard M. Upjohn, experts named by the Legislature, the stone ceiling of the Assembly chamber and united in a report in regard to its condition.

WALL AND WATER SUPPLY FOR CLINTON PRISON, DANNEMORA.

The work authorized by a law of 1887 for constructing a wall for this prison has been nearly completed, and a substantial stone wall, surmounted by a railing, now incloses the prison yard. Three guard towers have been erected in connection with the wall. A gate and its appurtenances still remain to be supplied.

Chapter 270 of the Laws of 1888 appropriated $3,500 to be expended under the direction of the State Engineer and Surveyor, and certified by the Superintendent of State Prisons, for iron pipe, hydrants, hose, two stone reservoirs and necessary grading for water supply at Clinton prison. Surveys have shown that the amount appropriated is not sufficient to accomplish this work.

THE LAND OFFICE.

As a commissioner of the land office of the State, the State Engineer and Surveyor has had under consideration sixty-one applications for grants of land under water, involving in many cases examinations of the property, rectification of maps and adjustment of lines and boundaries. Forty-three sales of State lands have been made by him realizing for the State $38,594.39.

Under the provisions of the Revised Statutes, the State Engineer and Surveyor has considered three applications for the settlement of disputed town boundary lines and has taken in each the prescribed legal action.

SOME DETAILS OF THE WORK OF THIS DEPARTMENT.

The work of this department includes the engineering required for ordinary canal work, and also that devoted to completing work begun last season and to making surveys, plans and estimates for new extraordinary work under the laws of the present year. The large number of contracts to be looked after is shown by the following list of final estimates filed this year.

LOCKS.	Final.	Bid.
1. Lock 31, Erie	$18,599 12	$21,079 00
2. Lock 32, Erie	22,098 84	23,991 50
3. Lock 33, Erie	24,354 87	26,200 00
4. Lock 34, Erie	21,739 03	24,563 50
5. Lock 35, Erie	21,586 50	22,857 00
6. Lock 44, Erie	25,882 10	28,154 00
7. Lock 45, Erie	28,592 39	28,407 75
8. Lock 53, Erie	21,975 38	22,276 50
9. Lock 54, Erie	22,732 85	23,799 50
10. Lock 55, Erie	23,206 67	34,986 00
11. Lock 56, Erie	28,266 87	28,502 00
12. Lock 60, Erie	24,574 39	25,895 50
13. Lock 61, Erie	23,760 19	26,175 00
14. Lock 62, Erie	25,021 26	26,509 50
15. Lock 72, Erie	26,901 01	26,683 25
Total Erie	$359,291 47	$390,080 00
16. Guard lock 4, Oswego	$13,696 15	$14,977 50
17. Lock 7, Oswego	21,086 68	22,930 50
Total Oswego	$34,782 83	$37,908 00
18. Lock 8, Black River	$9,355 65	$10,508 50
19. Lock 48, Black River	9,274 50	9,895 00
Lock 8, Black River	1,484 00	....
Total Black River	$20,114 15	$20,403 50
BRIDGES.	Final.	Bid.
20. Main street, Fort Plain	$9,154 66	$8,814 05
21. Parker street, Fairport	2,184 00	2,184 00
22. John street, Utica	9,031 63	9,000 00
23. West street, Syracuse	11,966 13	12,314 19
24. Glasgow street, Clyde	6,623 00	6,623 00
25. Main street, Brockport	9,549 69	10,398 40
26. Hudson street, Buffalo	13,027 70	13,077 00
27. Austin street, Buffalo	7,780 97	7,965 00
28. Main street, Tonawanda	9,265 80	9,154 00
Total bridges	$78,583 58	$79,529 64

CANAL IMPROVEMENTS.

	Final.	Bid.
29. Glens Falls feeder improvement	$2,055 33	$2,059 00
30. Beech street, Syracuse, improvement	3,626 84	3,274 00
31. Liverpool level, Syracuse, improvement	7,026 32	7,385 00
32. Champlain, first, improvement	9,075 08	8,982 70
33. Champlain, second, improvement	13,093 42	17,483 75
34. Champlain, third, improvement	14,602 98	17,274 25
35. Champlain, fourth, improvement	20,594 43	22,676 50
	$70,074 40	$79,135 20

MISCELLANEOUS.

36. Shinnecock canal, 1887, final	$27,067 17
37. Waste-weir, lock 33, Erie canal	1,885 95
	$28,953 12

NOT YET FINAL.

Oak Orchard creek improvement.
Crooked lake improvement.
Ship street bridge, Cohoes.

RECAPITULATION.

Total finals, Erie locks	$359,291 47
Total finals, Oswego locks	34,782 83
Total finals, Black River locks	20,114 15
Total finals, bridges	78,583 58
Total finals, canal improvements	70,074 40
Total finals, miscellaneous	28,953 12
Grand total	$591,799 55

NEW WORK.

Work under Laws of 1888 on which surveys, plans and estimates have been made:

1. Lock 27, Erie, let on bid	$24,356 00
2. Lock 28, Erie	26,595 00
3. Lock 29, Erie	24,529 00
4. Lock 30, Erie	32,851 65
5. Lock 63, Erie	23,655 00
6. Lock 64, Erie	29,971 50

7.	Lock 11, Oswego	$30,637 25
8.	Guard lock 3, Oswego	19,086 25
9.	Machinery, lock 11, Oswego, let on bid	2,655 77
10.	Machinery, Erie, locks 31, 2, 3, 4, 5, 44 and 45	10,500 00
11.	Arch culvert, Tonawanda, Goundry street, let on bid,	4,407 42
12.	Arch culvert, Tonawanda, Morgan street, let on bid,	3,953 00
13.	Arch culvert, Tonawanda, Adams street	4,942 30
14.	Canandaigua harbor, let on bid	14,135 00
15.	Albany basin	33,950 00
16.	Rome, wall, Whitesboro street	2,986 50
17.	Rome, wall, Lock street	1,046 00
18.	Rome, old canal drainage	7,215 60
19.	Mill Creek, Schenectady, let on bid	9,000 00
20.	Bridge street, Albany, abutment, let on bid	1,354 75
21.	Crooked lake	11,550 00
22.	Ship street, Cohoes, sub	5,754 60
23.	Ship street, Cohoes, super	1,868 00
24.	Lock 60, Black river, let on bid	13,891 50
25.	Havana basin	No award
26.	Champlain improvement 1, let on bid	2,334 00
27.	Champlain improvement 2, let on bid	19,977 50
28.	Champlain improvement 3, let on bid	3,903 25
29.	Champlain improvement 4, let on bid	6,978 00
30.	Champlain improvement 5, let on bid	1,575 00
31.	Champlain improvement 6, let on bid	12,894 50
32.	Champlain improvement 7, let on bid	4,585 00
33.	Champlain improvement 8, let on bid	5,087 50
34.	Champlain improvement 9, let on bid	1,240 30
35.	Ferry street bridge, Sandy Hill, let on bid	1,863 80
36.	Bridge street, Albany, super.	
37.	North Ferry street bridge, Albany, sub	2,116 20
	West Main street bridge, Rochester, sub.	8,378 20
38.	West Main street bridge, Rochester, super	20,960 00
39.	Litchfield street bridge, Forestport, super	2,394 00
40.	Buffalo street bridge, Ithaca.	
41.	Geneva street bridge, Lyons.	
42.	Schuyler street bridge, Utica.	
43.	Bear race, Waterloo improvement	12,875 00
44.	Broad street bridge, Waterford.	
45.	Hudson river, dredging.	
46.	Iron culvert, Ninth to Tenth streets, Rochester	2,807 46
47.	Claim surveys, eastern division.	

48.	Claim surveys, middle division.	
49.	Claim surveys, western division.	
50.	Water pipes, Dennemora prison.	
51.	Capitol park, Albany.	
52.	Cohoes dam.	
53.	Machinery, locks 27, 8, 9, 30, 31, 63 and 64	$6,600 00

The average cost of lengthened lock on Erie canal was $23,952.76 to which must be added $3,000 for engineering and inspection, making a total average of $27,000 per lock.

Average bid per lock, 1886, Erie	$20,549 50
Average bid per lock, 1887, Erie	26,005 33
Average bid per lock, 1888, Erie	27,159 69

The following is a summary of work done in the department of the State Engineer and Surveyor during the year 1888:

51.	Final estimates, work of 1887		$683,212 61
55.	Preliminary estimates		639,653 90
52.	Contracts, work of 1888		488,479 72
24.	Monthly estimates for January	$44,972 63	
26.	Monthly estimates for February	66,172 00	
28.	Monthly estimates for March	60,432 00	
38.	Monthly estimates for April	95,781 00	
15.	Monthly estimates for May	28,767 30	
12.	Monthly estimates for June	18,682 32	
29.	Monthly estimates for July	79,376 85	
20.	Monthly estimates for August	55,013 26	
8.	Monthly estimates for September	10,339 97	
14.	Monthly estimates for October	26,146 00	
22.	Monthly estimates for November	36,897 53	
	Monthly estimates for December	31,782 19	
			554,363 05

The above are 107 separate pieces of work.

SPECIAL APPROPRIATIONS.

Considerable inconvenience is occasioned by the fact that in special appropriations the State Engineer and Surveyor is directed to make surveys and plans, and it is also generally necessary to put engineers on construction under said special appropriations without any money appropriation to draw from. Now as the ordinary canal appropriation is often entirely insufficient for its legitimate purpose it would seem reasonable that an appropriation should be made establishing a fund, at least equal to ten per cent on the total amount of special appropriation, on which the State Engineer and Surveyor could draw for such work.

ORDINARY.

The ordinary appropriation of $25,000 should be increased to at least $30,000, on account of the greatly increased amount of work on ordinary canal repairs over what ruled when the amount was first put at $25,000, many years ago.

ENGINEERS.

The engineering staff now consists of:

Division engineers (one vacancy by death)	2	
Resident engineers	3	
Assistant engineers	7	
Levellers	8	
Rodmen	15	
Chainmen	9	
		44

Also temporarily not engaged:

Assistants	4	
Leveller	1	
Rodmen	2	
Chainmen	2	
		9
Grand total		53

The staff is now largely engaged in surveys and plans for special appropriations, and also on surveys for Board of Claims, of which a large number are called for by the Attorney-General.

The lock contracts let this summer will enable the force to be located for the winter by the first of December.

ENGINEERING EXPENSES FOR THE FISCAL YEAR.

ORDINARY REPAIR FUND.

Chapter 160, *Laws* 1887, *and chapter* 150, *Laws* 1888, *Deficiency Fund.*

DIVISION.	CANALS.					
	Erie.	Champlain.	Oswego.	Cayuga and Seneca.	Black River.	Chemung.
Eastern	$6,633 29	$3,417 30	....	....	....	....
Middle	5,395 58	....	$2,352 92	$232 24	$4,212 78	$62 51
Western	5,972 50	....	....	....	....	....
	$18,001 37	$3,417 30	$2,352 92	$232 24	$4,212 78	$62 51

Total.. $28,279.12.

EXTRAORDINARY IMPROVEMENTS.

ENLARGEMENT OF LOCKS.

Chapter 113, *Laws* 1887.

DIVISION.	CANALS.				
	Erie.	Champlain.	Oswego.	Cayuga and Seneca.	Liverpool level, Oswego.
Eastern	$16,582 04	$5,558 51	....	....	....
Middle	2,836 75	....	$5,435 53	$71 64	$1,008 80
Western	16,060 86	....	....	....	....
	$35,479 65	$5,558 51	$5,435 53	$71 64	$1,008 80

Total.. $47,554.13.

ENLARGEMENT OF LOCK 72, ERIE CANAL.

Chapter 463, *Laws* 1887.

Western division $3,143 95

ENLARGEMENT OF LOCKS AND IMPROVEMENT OF CANALS.

Chapter 416, *Laws* 1888.

DIVISION.	CANALS.				
	Erie.	Champlain.	Oswego.	Havana basin, Chemung.	Albany basin, Erie.
Eastern	$792 72	$1,373 81	....	....	$450 99
Middle	489 09	....	$1,106 80	$171 86	....
Western	1,021 57	....	....	....	....
	$2,303 38	$1,373 81	$1,106 80	$171 86	$450 99

Total .... $5,406.84.

SURVEYS FOR CLAIMS BEFORE THE BOARD OF CLAIMS.

Chapter 249, *Laws* 1888.

DIVISION.	CANALS.			
	Erie.	Champlain.	Oswego.	Chemung.
Eastern	$96 59	$101 79	....	....
Middle	690 93	....	$326 45	$182 84
Western	900 03	....	....	....
	$1,687 55	$101 79	$326 45	$182 84

Total .... $2,298.63.

SPECIAL APPROPRIATION.

Eastern Division.

Chapter 460, Laws of 1887, constructing wall, Clinton prison	$1,442 63
Chapter 270, Laws of 1888, iron pipe, hydrants, etc., Clinton prison	230 59
Chapter 126, Laws of 1888, bridge, Ship street, Cohoes,	110 78
Chapter 221, Laws of 1888, plans and specifications, Capitol park	616 74
Chapter 270, Laws of 1888, survey near Black river	1,549 21
Chapter 270, Laws of 1880, Shinnecock and Peconic canal	2,096 88
Chapter 173, Laws of 1888, Hudson river improvement,	4,990 77

Middle Division.

Chapter 646, Laws of 1886, widening Erie canal, near Lock No. 47	$624 18
Chapter 330, Laws of 1886, surveys Beaver river, reservoirs	800 00
Chapter 233, Laws of 1887, hoist bridge, West street, Syracuse	318 50
Chapter 234, Laws of 1887, dredging Crooked lake outlet	794 24
Chapter 274, Laws of 1887, hoist-bridge, John street, Utica	108 00
Chapter 371, Laws of 1888, dredging old canal at Rome,	186 34
Chapter 206, Laws of 1888, dredging Crooked lake outlet,	719 97
Chapter 192, Laws of 1888, improving Canandaigua lake harbor	165 40

Western Division.

Chapter 424, Laws of 1887, improving Oak Orchard creek and canal feeder	83 27
Chapter 118, Laws of 1887, bridge, Main street, Brockport	506 49
Chapter 402, Laws of 1887, bridge, Glasgow street, Clyde,	201 48
Chapter 587, Laws of 1887, bridge, Austin street, Buffalo,	267 93
Chapter 150, Laws of 1887, bridge, Cottage street, Lockport	79 61
Chapter 59, Laws of 1887, bridge, Hudson street, Buffalo.	63 61
Chapter 612, Laws of 1887, bridge, Parker street, Fairport	157 08
Chapter 585, Laws of 1887, bridge, Main street, Tonawanda	102 36
Chapter 546, Laws of 1888, bridge, Geneva street, Lyons,	74 12
Chapter 351, Laws of 1888, bridge, West Main street, Rochester	84 64
Chapter 348, Laws of 1888, South Tonawanda culverts..	296 95
Chapter 352, Laws of 1888, iron pipe under canal at Rochester	51 12

SUMMARY.

Ordinary Repair Fund.

Eastern division	$10,050 59	
Middle division	12,256 03	
Western division	5,972 50	
		28,279 12

Extraordinary Improvement.

Eastern division	$24,956 45	
Middle division	12,320 69	
Western division	21,126 41	
		$58,403 55

Special Appropriation.

Eastern division	$11,037 57	
Middle division	3,716 63	
Western division	1,968 66	
		16,722 86
Total		$103,405 53

TABLE showing the total cost for construction, maintenance and operation of the several State canals for the fiscal year ending September 30, 1888:

Erie and Champlain	$1,257,502 68
Oswego	94,031 87
Cayuga and Seneca	17,320 23
Chenango	1,426 23
Oneida Lake	139 60
Black River	67,311 43
Genessee Valley	2,250 00
	$1,439,982 04

TABLE showing the total cost for construction, maintenance and operation of the several State canals and their total revenues from their inception to September 30, 1888:

NAME OF CANAL.	Total cost for construction, maintenance and operation.	Total revenues from all sources.
Erie and Champlain	$97,175,850 08	$130,930,993 37
Oswego	8,266,500 55	3,717,906 93
Cayuga and Seneca	3,052,169 75	1,054,800 15
Black River	5,769.826 24	305,525 54
Genesee Valley	9,572,198 52	859,612 30
Chemung	3,428,252 41	525,425 97
Chenango	6,887,707 06	740,717 06
Oneida River Improvement	263,242 80	217,061 34
Oneida Lake	580,765 65	65,188 47
Baldwinsville	39,519 94	1,261 48
Crooked Lake	821,271 13	45,352 71
	$135,857,304 13	$138,463,845 32

The above statements of cost do not include the amounts paid for interest on canal loans which have been supplied by the surplus canal revenues and by taxation.

There has been raised by direct taxes for canals	$50,914,989 77
There has been raised by indirect taxes for canals	5,721,007 10
Total by taxes	$56,635,996 87
The canal revenues have been applied to general purposes of the State government to the extent of	18,850,411 94
Leaving of State revenues applied to canals	$37,785,584 93
September 30, 1888, there remained of the canal debt, less sinking fund	2,066,370 61
Leaving net loss through the canals	$39,851,955 54

TABLE showing the tonnage of the State canals and of the railroads competing with them for the period of twenty-six years, which have elapsed since the enlargement of the Erie canal:

Years.	Freight by canals. Tons.	Freight by railroads. Tons.
1862	5,598,785	3,020,388
1863	5,557,692	3,264,700
1864	4,852,941	3,727,946
1865	4,729,654	3,609,640
1866	5,775,220	4,844,989
1867	5,688,325	5,152,472
1868	6,442,225	5,754,842
1869	5,859,080	6,594,094
1870	6,173,769	8,974,505
1871	6,467,888	9,376,264
1872	6,673,370	9,958,239
1873	7,364,782	11,835,426
1874	5,804,588	12,478,954
1875	4,859,858	12,241,900
1876	4,172,129	12,776,498
1877	4,955,963	12,533,807
1878	5,171,320	13,845,981
1879	5,362,372	17,228,394
1880	6,457,652	19,248,930
1881	5,179,192	22,678,202
1882	5,467,423	23,225,631
1883	5,664,056	24,503,063

Years.	Freight by canals. Tons.	Freight by railroads. Tons.
1884	5,009,488	22,123,895
1885	4,751,784	21,071,446
1886	5,293,982	*25,443,353
1887	5,553,805	33,389,371
1888	4,492,948	35,881,558

THE LATE DENISON RICHMOND, DIVISION ENGINEER.

Just at the close of the past year the State lost from its engineer department one of its oldest and most faithful servants, Mr. Denison Richmond, division engineer of the middle division of the State canals, who died at Syracuse, October 4, 1888. Mr. Richmond entered the department in 1861 as rodman, and passing through all the grades of leveller, draughtsman, assistant engineer and resident engineer, became division engineer in 1884 and so remained till his death, thus completing a continuous service of twenty-seven years. His father, the late Van Rensselaer Richmond, was also in the engineer service of the State for more than twenty-four years, he too passing through various grades of service and being twice elected and serving as State Engineer and Surveyor.

Mr. Denison Richmond was a conscientious officer and a skillful engineer. His devotion to the duties of his office was intense. Of a gentle character and sweet disposition, he was loved by all who came in contact with him and in his official relations he commanded the respect and confidence of his associates. Realizing fully the loss, personal as well as official, which this department has sustained, it gives the State Engineer and Surveyor pleasure to be able to write this brief testimonial to the worth and ability of Mr. Richmond. The State may be congratulated that it has been able to find and retain so long in her service so faithful and excellent a man.

Respectfully submitted.

JOHN BOGART,
State Engineer and Surveyor.

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* Includes eleven months business of the West Shore Railway.

NEW YORK STATE CANALS,

EASTERN DIVISION.

REPORT OF CHAPMAN L. JOHNSON,

DIVISION ENGINEER,

FOR THE

YEAR ENDING SEPTEMBER 30, 1888.

EASTERN DIVISION.

STATE OF NEW YORK:

Division Engineer's Office, New York State Canals,
Albany, *October* 1, 1888.

Hon. John Bogart,
State Engineer and Surveyor:

Sir.— In accordance with custom and in obedience to the regulations governing the engineering department of the New York State canals, I have the honor to submit the following report on the condition of, and engineering operations on, the eastern division of the same, for the fiscal year ending September 30, 1888.

Description of the Eastern Division.

This division embraces that portion of the Erie canal, with its feeders and side-cuts, extending from the Hudson river at Albany to the dividing line between the counties of Herkimer and Oneida, and the whole of the Champlain canal, with its feeders, ponds and side-cuts. For convenience of maintenance and operation it is subdivided into repair sections, as follows:

Section No. 1, Erie, extends from the Hudson river to the head of lower Mohawk aqueduct, including the Albany basin and the side-cuts at Port Schuyler and West Troy, and also includes that portion of the Champlain canal extending from its junction with the Erie to the northerly end of bridge across the Mohawk river at Cohoes and the dam at Cohoes.

Section No. 2, Erie, extends from the head of lower Mohawk aqueduct to the head of lock No. 27.

Section No. 3, Erie, extends from the head of lock No. 27 to the head of lock No. 34.

Section No. 4, Erie, extends from the head of lock No. 34 to the westerly end of the division.

Section No. 1, Champlain, extends from the northerly end of Mohawk river bridge at Cohoes, to the north end of bridge across the Hudson river at Northumberland, including sloop lock and pond at Troy.

Section No. 2, Champlain, extends from the north end of bridge across the Hudson river at Northumberland, to the waste-weir at Dunham's basin.

Section No. 3, Champlain, extends from the waste-weir at Dunham's basin to Lake Champlain.

The mileage of canals, feeders and river improvements is as follows:

NAVIGABLE.

	Miles.
Erie canal, Albany to east line of Oneida county	106.243
Port Schuyler and West Troy side-cuts	.350
Albany basin	.770
Champlain canal, including Waterford side-cut and Cohoes and Saratoga dams	66.000
Pond above Troy dam	3.000
Glens Falls feeder and pond	12.000
Total	188.363

FEEDERS NOT NAVIGABLE.

	Miles.
Mohawk river, at Rexford Flats	.39
Mohawk river, south side, at Little Falls	.19
Mohawk river, at Rocky Rift	3.92
Schoharie creek	.63
Total	5.13

WATER SUPPLY — ERIE CANAL.

The 19.2 miles of this division, lying west of Little Falls, is supplied from reservoirs and streams on the middle division. East of Little Falls the supply is from the Mohawk river through the feeders at Little Falls, Rocky Rift and Rexford Flats, and from Schoharie creek through the Schoharie creek feeder. During the past year, the rainfall on the territory forming the water-shed from which this supply is obtained has been abnormally large, and consequently no serious difficulty has been encountered in obtaining sufficient water to maintain an easy and unobstructed navigation of the canal.

I would, however, call your special attention to the condition of the dam at Little Falls. This is a timber structure, now badly decayed, with crest out of level, through which large quantities of water leak, rendering it impossible in times of low water to feed the needed amount into the canal, and as a consequence a much larger draught has to be made on the supply coming from the middle division than should be. The demands on the feeder from the Black river country for supplying its quota of water needed on the Rome level, and the whole of that needed for the 22.5 miles of canal between lock No. 46 and Little Falls, are so great that as little as possible of this water, beyond that needed for locking, should be sent east of

Little Falls. Added to the fact that the present dilapidated condition of this dam renders impossible the proper and economical distribution to the canal of the available supply of water, is the further fact that the care of the structure is a source of constant expense and the danger of its sudden and entire failure is a serious menace to navigation. I would therefore renew the recommendation made by my immediate predecessor, that a new stone dam, the estimated cost of which is $15,000, be built at this point.

There is also one other difficulty in the way of a proper and uniform maintenance of water at the height required for navigation, which, though easily obviated, often gives considerable trouble, and causes unnecessary draughts on the supply coming from the middle division.

The Rocky Rift feeder is about four miles long, and no means of rapid communication exist between its termini. As a consequence, often while water is wasting over the crest of the dam, there is a deficiency in the canal below lock No. 34, and before an increased feed can be obtained through the feeder it becomes necessary to feed through the lock and thus unduly draw on the levels above. I recommend that telephonic communication be established between lock No. 34 and the Rocky Rift dam.

CHAMPLAIN CANAL.

The supply of water to this canal during the past year has been such that no difficulty has been encountered in maintaining navigation. The sources of supply are ample to meet any probable contingency of low water, even with entire prism of canal enlarged to forty-four feet on bottom with six feet depth of water (which is the basis on which all improvements are now being made), its summit level controlling the entire drainage of the Hudson river above Glens Falls, fed into the canal through the Glens Falls feeder, and this supply being supplemented on the north by the waters of Wood creek, entering the canal at Fort Ann, and on the south by waters of the Hudson at Northumberland and the Mohawk at Cohoes. It is, however, desirable that we should be able in times of low water to feed into the canal a large portion of this abundant supply, but in the present condition of the Glens Falls feeder this can not be done. Between a point 800 feet west of the Glen street bridge in Glens Falls and a point 5,000 feet east of said bridge the bottom of channel is a badly fissured rock, through the openings in which large quantities of water escape, and from the latter point for a distance of 4,000 feet farther east the stratum of rock underlying the channel is of the same character; but it is covered in places with a silt varying in depth from one to ten feet, and a small quantity of water finding its way through this silt to one of these fissures, the earth is worked into and through the fissure, causing the bottom to sink and great holes to appear through which there is a great loss of water. With the coming of every spring these holes are filled up and bottom repaired as well as the means at hand will allow, only to break out again in the old or some new places during the season of navigation. Added to the difficulty concerning the bottom of the channel is the fact that the walls on both sides of the canal, except those built within the past few years, are not properly filled with cement, and are otherwise imperfectly built, and a large amount of leakage passes through them. Observations made a year ago by Assistant Engineer E. B. Noyes, as given in the report of my predecessor, show that fully one-half of the water entering the feeder at the guard lock west of Glens falls, is lost before it reaches Sandy Hill. Since these observations were made about 1,200 lineal feet of good water-tight wall has been built on towing-path side of canal east of Glens Falls, but no repairs were made to the bottom, and only a small proportion of the leaks have been stopped.

Chapter 318 of the Laws of 1888 authorizes the repair of this feeder, and appropriates $20,000 to this purpose. This sum, together with a portion of the amount appropriated by chapter 416, Laws of 1888, will be expended during the coming winter in carrying out a well-considered and comprehensive plan for making water-tight as long a portion of this channel as the funds provided will allow, and I am of the opinion that, if the Legislature, at its ensuing session, should make a further appropriation of $20,000, this amount could be judiciously and profitably expended here. Plans for doing the proposed work are in progress, and will be shortly submitted to you.

ERIE CANAL — PRISM AND BANKS.

The usual spring cleaning of prism was done. The improvement of the tow-path by gravelling has been continued, and the greater part of it is now in fair condition. There yet remains, however, much of it which is very low, more especially the entire level between locks 18 and 19, and to these portions special attention should be paid next year.

SLOPE AND VERTICAL WALLS.

No material change has been made during the past year in the condition of walls on this canal, except where short pieces have been built in connection with lengthened locks and new waste-weirs.

DOCKING.

The timber docking on many portions of this division, more particularly at Schenectady, Big Nose, and above lock No. 34, is in very bad condition. My predecessors have referred to this matter for several years past, but as yet the necessary funds for its repair have not been provided, and the deterioration steadily progresses with the lapse of time. I am of the opinion that provision should be made at the next session of the Legislature, either for the thorough repair of the docking at the three places above named, or for its replacement by stone walls. The building of stone walls upon the long stretches of canal now occupied by this docking would entail a large outlay of money, and the fact that this timber work is generally about thirty-three years old, while only for the past ten years has its decaying condition been the source of any considerable care and expense, convinces me that the wisest and most economical course would be the rebuilding of the timber structures.

NAVIGATION.

Navigation has been uninterruptedly maintained throughout the year.

IMPROVEMENTS AND REPAIRS.

Classifying all improvements and repairs made from funds provided by the act of the Legislature making appropriations "to pay expenses of ordinary repairs and maintenance of the canals" as "ordinary repairs," and all improvements and repairs made in pursuance of special acts of the Legislature as "extraordinary repairs," I would make the following report of work done during the past year, with recommendations concerning that which, in my opinion, should be done.

The Superintendent of Public Works has made a reënumeration of bridges on this division and has had a number assigned to each bridge which is owned and maintained by the State. This number has been plainly painted on each tow-path abutment. I have had prepared and append to this report a new table of bridges, based on this enumeration, and all references herein are to these new numbers.

ORDINARY REPAIRS — ERIE CANAL.

The locks have been maintained in a state of efficiency and all repairs to bottoms which were considered necessary were made last spring. Twenty-eight old lock gates have been replaced with new ones. During the coming winter the bottoms of locks Nos. 14, 35 and 36 should be examined, replanked and where necessary holes below planking filled with concrete. The work of replacing old gates with new ones should continue as fast as new gates can conveniently be turned out of the State shops.

Aqueducts.

Repairs sufficient to secure the safety of the structures for the present year were made on trunks of upper and lower Mohawk aqueducts. These trunks, which were built in 1875, are beginning to show decided signs of age and will shortly have to be either extensively repaired or entirely rebuilt. The extraordinary ice-gorge on Schoharie creek resulted, on March twenty-second, in carrying away all the timber from five spans of aqueduct over this creek and seriously damaging all of the others. Repairs were promptly made and structure put in good condition prior to the opening of navigation, masonry was not damaged. The channels above many of the aqueducts, more particularly at "Flat Stone Creek" are badly filled up and should be cleaned out.

Waste-weirs.

Waste-weir at Schenectady street, West Troy and waste-weir out of the Mohawk basin at West Troy should have new bulkheads.

The waste-weir just above lock No. 20 has been referred to in several annual reports preceding this and reported in all as being in a dangerous condition. Its condition is no worse to-day than it was two years ago; but in my opinion it is liable to fail at any time and as the bank here is high, its failure would entail a large expense. I recommend that it be rebuilt.

The waste-weir on berme side above lock No. 33, used for feeding around lock, having been closed up by the lengthening of this lock, a now one was built last spring by Soulé & Raynor, contractors, 300 feet above new lock and a new channel cut at foot of berme embankment to carry the water discharging from it.

The timber waste-weir which was built about six years ago on towpath side of canal about one-quarter of a mile above lock No. 33 and which failed by leakage in foundation immediately after construction and was therefore never brought into use, was replaced last spring with a substantial and water-tight stone structure.

Bridges.

The following eight bridge superstructures have been renewed this year: Nos. 28, 62, 64, 68, 69, 151, 155 and 164. The following should be renewed: Nos. 13, 75, 77, 106, 126, 130, 132, 137, 140, 143, 144 and 147. New berme abutments have been built at bridges Nos. 73 and

92. Berme abutments of Nos, 75, 81, 113, 125 and 130, which hung so badly towards the canal as to be in danger of falling have been successfully dug behind and thrown back and are now safe structures, good for many more years.

There are about eight other abutments which should be similarly treated.

EXTRAORDINARY REPAIRS — ERIE CANAL.

Lengthening locks (chapter 113, *Laws of* 1887*).*

The report of my predecessor gives a list of the several locks selected by the State Engineer and Surveyor and the Superintendent of Public Works to be lengthened, in pursuance of this law, with a table showing awards of contracts therefor. The lengthening of these locks was accomplished as follows :

Lock No. 31.— Clinton Beckwith, contractor — Berme lock lengthened at foot. New lock was founded on bearing piles of an average length of thirteen feet. The face stone was principally obtained from quarry at Canajoharie, supply being supplemented from quarry at Palatine bridge. This stone is a very hard and compact limestone, very difficult to cut or dress, but making a handsome and durable structure. The backing came from quarries at Canajoharie and Sprakers.

Lock No. 32.— Soule & Raynor, contractors — Berme lock lengthened at foot. Founded on bearing piles eight to fourteen feet long. Stone from quarry known as Fox's, about two and one-half miles east of St. Johnsville. This is a good and durable limestone, though not so compact and hard as that at Canajoharie, and consequently not so expensive to cut and dress. The work here was well done, and I doubt not a durable structure has been obtained.

Lock No. 33.— Soule & Raynor, contractors — Berme lock lengthened at head. Bearing piles were ordered for this lock, but on making the necessary excavation a coarse, clean gravel was encountered, into which piles would not penetrate. Foundation timbers were therefore laid on concrete. Pile-fender as per plan was found practicable. Stone was obtained from same quarry as that for lock No. 32, and workmanship on lock was of equally good character.

Lock No. 34.— Leavey & Buckley, contractors — Berme lock lengthened at the foot. A "hard pan" bottom, into which piles could not be driven, was encountered here, and foundation was constructed in a manner similar to that described for lock No. 33. Fender-piles could not be driven and one crib at foot of old tow-path lock was built forty feet long, and another at foot of new lock, and between these two cribs a row of eighteen piles was planted in a trench sunk four feet into the hard pan, with foot of piles secured by filling in trench with well-packed stone. The face-stone for this lock was mainly obtained from the gray-lime quarry, known as "Neffs," located about two and one-half miles east of Amsterdam, the deficiency being supplied from Canajoharie and Sprakers. The backing came from Canajoharie and Sprakers. The contractors having relied on obtaining their face-stone from the "Neff" quarry, but having failed to make delivery of the same before the breaking up of the roads came, consequent upon the spring thaws, it was with great difficulty that this work was pressed forward to such a state of completion as to avoid an obstruction to navigation. On the second day of April, Resident Engineer John P. Kelly addressed a communication to the Superintendent of Public Works, calling his attention to the backward condition of this work, the failure of the contractors to make the needed delivery of stone, and to the difficulty and expense attending such delivery from the Neff quarry on account of the condition in which the roads then were and in which they might reasonably be expected to remain until the time for opening of navigation should arrive, and recommending that the Superintendent of Public Works should take charge on behalf of the State and at the expense of the contractors, of the delivery of the face stone still needed for this lock.

In reply to this communication the Superintendent of Public Works in a letter dated April 3, 1888, directed Mr. Kelly to "employ a sufficient force and purchase the necessary materials to complete the work, or such portion of it as may be necessary to secure navigation, according to the terms of the contract and specifications." Acting under these instructions Mr. Kelly, while not deeming it necessary to take the management of the work entirely out of the hands of the contractors by insisting on and securing a large increase in the force at work on this lock, and the drawing on quarries at Spraker's and Canajoharie to relieve the necessity of transporting all the needed face-stone over the heavy roads between the Neff quarry and Port Jackson, succeeded in so far advancing the work that by the day set for opening the canal the masonry had all been carried up above the water line, leaving the placing of a portion of the coping and wing walls of lock, the insertion of gates and some grading back of lock wall to be done after the opening of navigation.

Lock No. 35. — McLean & Rockwell, contractors — Berme lock lengthened at foot. Founded on piles five and one-half to eight and one-half feet long. The large bulk of the face-stone is the gray limestone from "Neff" quarry heretofore referred to, being supplemented by a small quantity from the Canajoharie quarries. Backing was obtained from the Palatine Bridge, Canajoharie and Neff quarries.

The contractors having failed to provide the necessary materials or to so conduct the work as to avoid serious danger of retarding the opening of the canal, on the 3d day of April, 1888, the Superintendent of Public Works directed Resident Engineer John P. Kelly to "employ a sufficient force and purchase the necessary materials to complete the work according to the terms of the contract and specifications." Acting on these instructions Mr. Kelly took charge of work at the quarry on April fourth, and of work at the lock on April fifth, completing the structure in time to avoid any delay to navigation.

Lock No. 44.— Daniel Ford, contractor — Berme lock, lengthened at foot. Founded on piles eight and one-half to fourteen and one-half feet long. The face-stone used in this lock is a mixture from several quarries. Below the line of water surface in lower level some of them are from a quarry located near Newport, on the Herkimer, Newport and Poland railroad, and yielding a soft blue limestone; but owing to the danger of the breaking away of the corners and joints of this soft stone by the action of boats coming in contact with the sides of the lock, its use was not allowed in the upper portion of the walls. The remainder of the face-stone was obtained from quarries on Sugar river and at Split Rock, Sprakers and Canajoharie. The greater part of the backing came from the Spraker quarry. Although this lock was not completed before the time set for the opening of the canals, the masonry was brought to such a height that navigation was not interfered with and the structure was completed before June first.

Lock No. 45.— John Moore, contractor — Berme lock lengthened at foot. This is the only one of the seven locks lengthened on this division last winter at which serious difficulty was encountered in the foundation. The bottom was found extremely soft and test-piles with followers were driven so that the point penetrated to a depth of sixty feet below canal bottom, and did not, even at this depth, reach any firm bearing. The original plan for this lock proposed the placing of six piles under each timber laid at right angles to axis of lock and extending under both chamber walls, so arranged that three piles were located under each wall. This was changed and five piles were driven under each wall and one in center of chamber. These piles varied from twenty-four to thirty feet in length, though none of them reached a firm bearing, but on the contrary yielded about as much to the last blow of the hammer as they did to the first; the friction upon the sides of this increased number of piles has been sufficient to sustain the structure and no serious settling has taken place. The face-stone for this lock is of the Onondaga county grey lime and the backing was obtained from quarries near Newport and at Sprakers. The structure was completed, with the exception of the insertion of the gates, before the opening of navigation.

Improvement of Mill Creek.

Chapter 635, *Laws of* 1887, *and chapter* 133, *Laws of* 1888.

The city of Schenectady having, in pursuance of the requirements of chapter 133, Laws of 1888, obtained the necessary right of way for the proposed culvert for conveying the waters of Mill Creek from the culvert under the Erie canal to the Mohawk river, a contract was, on September 28, 1888, entered into with Andrew Kinnum, of the city of Schenectady, to construct said culvert for the gross sum of $9,000. This work will be at once proceeded with.

Lift-bridge at Main Street, Fort Plain.

Chapter 311, *Laws of* 1887, *and chapter* 30, *Laws of* 1888.

This bridge has been completed and is in satisfactory working order, the motive power being generated through a fourteen-inch Lessner turbine wheel, discharging through a ten-inch pipe into the creek below the bridge. The appropriations for this work were :

Chapter 311, Laws of 1887	$7,500 00	
Chapter 30, Laws of 1888	2,500 00	
		$10,000 00
And the cost has been :		
Substructure	$1,859 66	
Superstructure	7,295 00	
Laying iron pipe, grading, advertising, etc	417 06	
		$9,571 72
Unexpended balance		$428 28

The substructure was built by Soule & Raynor, of Syracuse, N. Y., contractors, and the superstructure by the Hilton Bridge Construction Company, of Albany, contractor.

Lengthening Locks.

Chapter 416, *Laws of* 1888.

This law authorizes the lengthening of five or more locks east of Syracuse, locks Nos. 26, 27, 28, 29 and 30 having been designated by the Superintendent of Public Works and State Engineer and Surveyor.

I have caused to be prepared plans for lengthening same and estimated cost thereof, as follows :

Engineer's estimate for lengthening locks on Erie canal, in pursuance of chapter 416, *Laws of* 1888.

	Estimated cost of work.	Estimated cost of engineering.	Total.
Lock No. 26 to be lengthened at head	$27,254 60	$2,725 46	$29,980 06
Lock No. 27 to be lengthened at foot	24,492 50	2,449 25	26,941 75
Lock No. 28 to be lengthened at foot	26,768 50	2,676 85	29,445 35
Lock No. 29 to be lengthened at foot	25,379 50	2,537 95	27,917 45
Lock No. 30 to be lengthened at foot	33,238 00	3,323 80	36,561 80
Machinery for drawing boats into five locks	6,500 00	100 00	6,600 00
Total	$143,633 10	$13,813 31	$157,446 41

At a letting held on the thirty-first day of July, lowest bids received using estimated quantities at contract prices were as follows:

Lock No. 26, Costello, Nagle & Co	$27,074 28
Lock No. 27, Costello, Nagle & Co	24,356 00
Lock No. 28, Costello, Nagle & Co	26,595 00
Lock No. 29, Whalen Brothers	24,529 00
Lock No. 30, Hughes Brothers	32,851 65
Machinery on five locks, Wm. B. Wemple's Sons	5,500 00
Total contractors' bids	$140,905 93
Total engineer's estimates	143,633 10
Excess of engineer's estimates	$2,727 17

These bids taken in connection with those made for the two locks on the western division and making a proper allowance for the necessary expenses of advertising, engineering and inspection were found to exceed the total appropriation of $200,000 made by the Legislature and it was therefore decided to drop lock No. 26 from the list and contracts were awarded to the lowest bidders, as above noted, for lengthening locks Nos. 27, 28, 29 and 30 and for placing machinery on these four locks. Contractors are now engaged in delivering the necessary materials for the work.

DEEPENING OR BOTTOMING OUT THE ERIE CANAL.

Chapter 416, *Laws of* 1888.

This law appropriates the sum of $100,000 for the above-mentioned purpose, but it has been deemed wise to defer the preparation of plans and estimates for expending any portion of this sum on the eastern division until the close of navigation, when the possibility of making a closer examination of the condition of the prism and the culverts under it, with the location of bases of vertical and slope walls will render possible a more intelligent determination of the best locations and methods for carrying out this improvement.

DREDGING ALBANY BASIN.

Chapter 416, *Laws of* 1888.

The sum of $40,000 is appropriated for the purpose of bottoming out the Albany basin "to its legal depth of seven feet of water at low tide." I have had necessary plans prepared and estimate total excavation necessary to clean out the entire area of the basin to a depth of seven feet, at 188,000 cubic yards. At a letting held on the thirty-first of July, 1888, three bids were received at 29 cents, 34.9 cents and 39 cents respectively, all of which were rejected by the Superintendent of Public Works as being excessive and the work was readvertised. At the second letting, J. Van Patten & Co. were the lowest bidders at 24¼ cents per cubic yard and a contract has been awarded to this firm and work is now in progress and will be prosecuted until as large an amount of the deposit in this basin as the funds available will allow, is removed.

NEW BRIDGES.

Chapter 96, *Laws of* 1888,

Authorizes the construction of an iron bridge over canal at Bridge street, in the city of Albany, and the making of necessary alterations in the masonry for the same and makes an appropriation of $5,000 therefor. An examination disclosed the fact that the berme abutment had settled and was not in condition to receive the new iron superstructure and it was therefore decided to rebuild this abutment.

Plans and estimates for this new structure have been prepared and bids for substructure will be received by the Superintendent of Public works on October ninth. I estimate cost of work as follows:

Substructure	$1,936 00
Superstructure	2,400 00
Total	$4,336 00

Chapter 70, *Laws of* 1888.

Authorizes the construction of an iron bridge over canal at Litchfield street, Frankfort, and appropriates the sum of $3,000. The berme abutment has settled badly and is not in condition to receive a new iron superstructure. Plans for this work are being prepared and will be shortly handed to you; but as I estimate the cost of same at $3,980, I do not think the amount appropriated will be found sufficient.

LIFT-BRIDGE AT NORTH FERRY STREET, ALBANY.

Chapter 70, *Laws of* 1888,

Authorizes the building of this bridge, and makes an appropriation of $14,000 to defray cost thereof. Plans for the same are in course of preparation and contract will be let in time for the building of the bridge during the coming winter.

CHAMPLAIN CANAL.

The funds available for ordinary repairs to this canal are so limited and the demands on same for keeping it in a navigable condition, so great that little permanent improvement can be expected from this source; but the special appropriations made by the Legislature within the past six years have so improved those portions of the canal to which they have been applied as to warrant the hope that the succeeding Legislatures will continue the annual appropriation of funds for its improvement until the desired object of obtaining a channel forty-four feet in width at bottom with a depth of six feet of water for its entire length is obtained.

The old slope walls and docking are in many places badly dilapidated and have so settled as to leave the inner angle of the towing-path entirely unprotected and the action of the water is slowly, but constantly washing away and narrowing the towing-path. In such places where the berme bank is in excavation and the towing-path in embankment, and where the other natural features warrant such treatment, I recommend the avoiding of the heavy expense of building stone walls, by the adoption of the policy successfully carried out on a portion of the improvement of last winter, of protecting the inner angle by means of a layer of small stone, laid at a slope of one and one-half feet horizontal to one foot vertical, extending from the top angle of towing-path to a point one or two feet below water surface, and leaving the remainder of the slopes unprotected, obtaining the necessary increased width by earth excavation on the berme side. Where a good foundation can be had for the foot of this stone protection, at about the depth mentioned above, this will be found effectual in preventing the encroachment of the water on the towing-path embankment, so long as the boats continue to be mainly propelled by horses, which, up to the present time, has been the power almost exclusively used on this canal.

The towing-path, more especially on section No. 1, is very low, in many places water being carried in canal at from three to six inches below its top angle. I recommend that an increased number of boats be provided for this canal, and tow-path raised with gravel transported to its destination during the period of navigation.

Delays to navigation.

On October 2, 1887, a leak occurred through dry vertical wall on berme side over Salisbury's culvert on the sixteen-mile level. Water penetrated earth covering over culvert, passed along top of arch and down behind south wing-wall and discharged under the foundation. Water was at once drawn from level, bank was excavated to top of arch and replaced with well puddled material protected at base with sheet piles. Water was let into level on October fourth, and navigation resumed on the seventh, making a total suspension of five days.

On May tenth, at 4 A. M., a leak was discovered through old docking and embankment on berme side at head of lock No. 7. Water was drawn, repairs made and navigation resumed at 2 P. M., October eleventh ; total suspension of navigation thirty-four hours.

On May twelfth a slight break in tow-path embankment, just above lock No. 4, caused a suspension of navigation of twelve hours.

On September sixteenth a leak in lock No. 3, Glens Falls feeder, necessitated the drawing of water from levels above, suspending navigation on the feeder for thirty hours.

The principal repairs and improvements made during the year, and those most urgently needed, are as follows :

ORDINARY REPAIRS — CHAMPLAIN CANAL.

Locks.

No extensive repairs have been made to any of the locks during the year. On September sixteenth a leak of considerable magnitude sprung under foundation of lock No. 3, Glens Falls feeder, the repair of which necessitated the drawing of the water. It was only possible to make temporary repairs. On the close of navigation I will make a thorough examination of this structure, and report what measures are necessary to make it safe. The walls are in bad condition, the foundation has been undermined, and it may be necessary to tear down and rebuild a portion of the lock. The sluice around the five combined locks (Nos. 6 to 10), on the Glens Falls feeder, should be rebuilt during the coming winter.

Dams.

The ice of last winter did considerable damage to the apron of the dam across the Mohawk at Cohoes, about 220 feet of same being entirely carried away and 150 feet more or less injured. As soon as the water subsided sufficiently to allow an examination of this dam to be made, I discovered that for a length of 220 feet, extending northward from a point 696 feet north of south abutment, the stone structure was in a dangerous condition. Many of the face stones had fallen out, and many of those remaining had become displaced and large streams of water were passing through the dam. Two buttresses, seventy-five feet and thirty-one feet long respectively, were built in front of the portion from which the face-stone had fallen, and an enlarged apron constructed in place of that washed away. I think this portion of the dam, as well as that covered by buttresses built in 1885 and 1886, is now safe. Between points 200 and 400 feet north of the south abutment, a motion in crest of dam of five inches has taken place within the past two years. Two buttresses of about twenty-five feet each in length should be built here, and the entire apron, except that portion renewed this year, enlarged and raised. The apron and crest of dam across the Hudson river at Troy have been extensively repaired during the year.

Aqueducts.

The trunk of Schuylerville aqueduct was partially renewed last winter. The old timber remaining should be replaced with new this winter.

The trunks of aqueducts at Moseskill and Fort Edward need extensive repairs, if not entire renewal.

Waste-weirs.

The waste-weirs on this canal, except the one at head of lock No. 7, which will be rebuilt this winter, are in fair condition.

Culverts.

The parapet and wing-walls on berme side of culvert at Salisburys have become very dilapidated, and should be rebuilt this winter.

About one-fourth of a mile below Fort Miller lock is a stone culvert, the portion under canal proper being a "box," and that under the towing-path an "arch." The latter portion has failed and should be removed, and the "box" extended through the towing-path.

Bridges.

The following new superstructures have been erected: Nos. 2, 7, 15, 18, 25, 31, 43, 44, 47, 48, 112, 115, 129, 134 and 149, on the Champlain canal and Nos. 2, 5 and 13 on the Glens Falls feeder.

The following should be rebuilt during the next year: Nos. 1, 9, 12, 24, 26, 27, 35, 41, 42, 45, 50, 53, 57, 59, 72, 73, 89, 113, 124 and 142, on the Champlain canal, and No. 4 on the Glens Falls feeder.

The only new abutment built during the past year is the one included in contract No. 3, and hereinafter referred to. While there are ten abutments on this canal which should be shortly rebuilt, the only one not provided for by work to be done by contract, which must be rebuilt this winter, is the berme abutment first south of Eastman's waste-weir on the Whitehall level.

EXTRAORDINARY REPAIRS — CHAMPLAIN CANAL.

Improvement of Champlain Canal (chapter 441, *Laws of* 1886).

The reports of my predecessor for the years ending September 30, 1885, 1886, and 1887, respectively, give detailed statements of the disposition of the sums reappropriated for the improvement of the Champlain canal, by the various acts, chapter 97 of Laws of 1882, 301 of Laws of 1884, and 441 of Laws of 1886, and his last report shows a balance remaining in treasury of $7,086.33, and states that by resolution of canal board of September 1, 1887, the balance was set apart as follows, for work at Wilbur's basin, $5,336.33; and for dredging between Fort Ann and Fort Edward, $1,750.

Before any of the above-mentioned funds were expended, the canal board revoked its action of September 1, 1887, and set apart this fund to be expended by the Superintendent of Public Works as follows:

December 28, 1887 — For stopping leaks on the Glens Falls feeder	$5,336 33
July 25, 1888 — For building vertical wall on Glens Falls feeder	1,750 00
Total	$7,086 33

The work referred to in this action of the Canal Board was done during the past winter, partly by the Superintendent of Public Works directly, and partly through contract with Swan & Reilly.

Fishway in Troy Dam (*chapter* 512, *Laws of* 1887).

In pursuance of this law a fish-way, similar in general design to those heretofore placed in State dams at Schoharie creek and Rexford flats, has been built here by Albert Blaisdell, contractor, at a cost of $1,800.

Improving Champlain Canal (*chapter* 113, *Laws of* 1887).

The report of my predecessor gives a description of work proposed to be done under this law with a list of four contracts which at that date had been awarded. In order, however, to provide means to make urgently needed repairs on the Glens Falls feeder, it was necessary to considerably reduce the quantity of work covered by the above mentioned four contracts which was done as follows: On contract No. 2 no work was done on the southerly 300 feet. On contract No. 3 no work was done on the 1,150 feet of canal lying between the fifth and sixth bridge south of the Fort Edward aqueduct, and on contract No. 4 no work was done on the northerly 300 feet, and the proposed area of tow-path lining was reduced on all the contracts. On contract No. 1 it was proposed to widen canal on berme side from a point beginning at bridge first north of waste-weir, running north about 650 feet and to leave the berme side of canal unprotected. There is a high clay hill at this point, and when excavation came to be made it was found that this plan could not be carried out, and the treacherous nature of the material, yellow clay, with layers of quicksand running through it, rendered it absolutely necessary to build 163 lineal feet of heavy retaining wall, to prevent a threatened landslide. This wall was successfully built, and the danger averted, but in consequence of the necessary abandonment of the original plan of widening on berme, there yet remains at this point about 440 feet of very narrow canal, the improvement of which has been provided for in work proposed to be done during the ensuing winter.

On contracts Nos. 2, 3 and 4, considerable trouble was experienced on account of the sliding of the newly-made clay embankments, which at one time threatened to be serious. The superintendent of this section has, however, during the summer, been gradually putting on sufficient material to keep the banks up to grade, and as the movement has now about ceased, I apprehend no further trouble from this cause. The berme abutment built on contract No. 3 (bridge 97), by the reason of the yielding of the clay foundation under the excessive pressure of the clay filling in the rear thereof, has failed, and will have to be rebuilt. In addition to the four contracts noted above, a contract was awarded on April 2, 1888, to Swan & Reilly, for building

290 lineal feet of vertical wall on the Glens Falls feeder, engineer's estimate of cost of which was $1,965.

All of the above-mentioned five contracts have been completed and final accounts rendered therefor. The fund has been disposed of as follows:

Total appropriation made by the Legislature		$70,000 00
Amount of five final accounts (see table annexed)	$58,736 91	
Cost of engineering (including survey of canal from lock 7 to lock 15)	8,705 50	
Cost of inspectors, advertising, etc	2,558 59	
		$70,000 00

Ship Street Bridge, Cohoes (*chapter* 168, *Laws of* 1887, *and chapter* 126, *Laws of* 1888).

The appropriation of $6,000 made by chapter 168, Laws of 1887, having been found to be insufficient for the purpose of building abutments, approaches and superstructure at this point, the act chapter 126, Laws of 1888, making an additional appropriation of $2,000, was passed, and contracts have been entered into with James E. Flood for substructure and approaches, and with the Hilton Bridge Construction Company, for superstructure. The contractor for substructure is now at work, and will complete tow-path abutments and approaches before the close of navigation.

The iron bridge is in process of manufacture, and the whole structure should be completed within a month of close of navigation.

Lift-bridge at Broad Street, Waterford (*chapter* 320, *Laws of* 1888).

This law authorizes the construction of a lift-bridge at this point, and appropriates the sum of $10,000 to be applied thereto. I have had made a careful survey of this locality, and will shortly present to you plans and estimates therefor. The fact that the natural surface of the ground is low on the easterly side of canal and high on the westerly, renders the question of determining the grade which will give most relief to traffic, with a minimum amount of damages to private property on the westerly side of canal, a difficult one.

BRIDGE OVER GLENS FALLS FEEDER, AT FERRY STREET, SANDY HILL.

Chapter 570, *Laws of* 1888.

This law makes an appropriation of $2,500 dollars for building a bridge at this point. Plans for the same will shortly be handed you. I estimate cost of abutments, approaches and wooden bridge at 2,438.

IMPROVEMENT OF CHAMPLAIN CANAL.

Chapter 416, *Laws of* 1888.

This law authorizes and directs the Superintendent of Public Works to improve the Champlain canal by deepening it at such points as he shall deem most important, and appropriates the sum of $105,000 to be applied to such of the above-described improvements of the Champlain canal, as in the judgment of the said Superintendent of Public Works, the present needs of commerce most require.

On the ninth day of August, I detailed Assistant Engineer E. B. Noyes, with a corps of assistants, to duty on this canal, and placed him in charge of making the necessary surveys, maps, plans and estimates, and after due consultation with the Superintendent of Public Works and his representatives, I have approved and forwarded to you, maps, plans and estimates for work as follows :

No. 1. "For protecting berme bank and rebuilding waste-weir at head of lock No. 7."

The improvement contemplated is the widening of canal on berme side and the deepening of prism to six feet of water, the building of 113 feet of vertical wall in cement between head of lock and waste-weir, and the rebuilding of the dilapidated waste-weir.

No. 2. "For improving 10,300 feet of canal between lock No. 7, and a point 4,100 feet north of lock No. 8."

The work contemplated is the improvement of entire prism of canal lying between the points named, except that portion included in Nos. 1 and 3 of this list, by widening on berme side of canal and bottoming out prism so as to obtain a channel forty-four feet wide at a point six feet below water-surface, with such slopes on interior banks of canal as may be necessary; the raising of tow-path with gravel; protecting the inner angle of towing-path with quarry chips extending from its upper surface to a point one foot below water-surface, and the widening of towing-path to fourteen feet on top.

No. 3. "Improving 635 feet of canal extending from head of lock No. 8 northward."

The proposed improvement is the widening of canal on the towing-path side and protecting same with slope wall, the deepening of prism to six feet of water; the building of a vertical wall in cement on berme side from head of lock to waste-weir, and the strengthening and puddling of the leaky embankment on berme side north of the waste-weir.

No. 4. For "improving 440 feet of canal northward from a point 163 feet north of first bridge, north of Wilburs basin waste-weir."

This proposed improvement is the building of 440 lineal feet of vertical wall in cement on the berme side of canal and of about 200 feet on tow-path side, and the widening and deepening necessary to obtain a prism forty-four feet wide on bottom with six feet of water. The vertical wall on berme side is a continuation of that built last winter by Sherman & McDonough, contractors, and is necessary in order to retain the high clay and quicksand hill at this point.

No. 5. "Improving 175 feet of canal on berme side at Salisbury's culvert."

The proposed improvement is the strengthening 175 feet of the weak and leaking berme bank by building a vertical wall in cement, over and on both sides of the culvert. This is a very dangerous place in its present condition and a leak which started here last fall, would have entailed very serious damage had it not been promptly discovered and repaired.

No. 6. "Improving 1,500 feet of canal south of second bridge (No. 52), north of Salisbury's culvert."

The proposed improvement is the widening on tow-path side and deepening of this portion of canal so as to obtain a prism of forty-four feet on bottom with six feet of water; the protection of towing-path bank by a slope wall and a puddle trench, and the driving of a row of piles on berme side to prevent the clay hill from sliding into canal. The canal here now is very narrow and two boats can not pass.

No. 7. For "improving 1,280 feet of canal opposite Gate's Headquarters, about three-fourths of a mile south of Schuylerville."

The proposed improvement is the widening on berme side mainly in rock cutting and deepening of canal so as to obtain a prism of forty-four feet on bottom with six feet of water. Canal is now very narrow and two boats can not pass.

No. 8. For "improving 1,160 feet of canal and building two new bridge abutments and one new bridge superstructure at the third bridge (No. 80) south of Moses Kill lock (No. 14)."

The proposed improvement is the widening on berme side, in rock cutting and the deepening of canal so as to obtain a prism forty-four feet wide at bottom with six feet of water. This necessitates the building of two new bridge abutments and one new superstructure.

No. 9. For "rebuilding berme abutment of second bridge No. 88 north of Satterlee's waste-weir."

This improvement consists in the rebuilding of berme abutment, mentioned heretofore in my remarks on contract No. 3 of improvements under chapter 113, Laws of 1887.

I estimate cost of above work, including engineering, as follows:

Contract No. 1	$2,461 00
Contract No. 2	19,438 00
Contract No. 3	3,572 00

Contract No. 4	$7,676 00
Contract No. 5	1,583 00
Contract No. 6	13,568 00
Contract No. 7	5,252 00
Contract No. 8	6,158 00
Contract No. 9	1,437 00
	$61,145 00
Add for advertising, inspection and contingencies	5,000 00
Total	$66,145 00

I am of the opinion that about $20,000 of the fund provided by this law should be expended in the work heretofore referred to under the head of "water supply" in stopping leaks on the Glens Falls feeder.

CLINTON PRISON — DANNEMORA.

The work authorized by chapter 460, Laws of 1887, has been completed with the exception of placing an iron gate (with necessary machinery for operating and locking the same from the guard tower) in the eastern wall. A contract has been made for furnishing and erecting this gate and machinery, cost of which I estimate at $500. A substantial stone wall, twenty feet high surmounted by a gas-pipe railing now incloses the prison yard and three guard towers, supported by iron beams or posts, covered with corrugated iron have been erected that guards stationed in three towers can patrol the top of the wall.

Chapter 270, Laws of 1888, appropriates the sum of $3,500 to be expended under the direction of the State Engineer and Surveyor and to be certified to by the Superintendent of State Prisons, for obtaining a water supply for Clinton prison by conducting a mountain stream to and through the prison yard by means of iron pipes and for furnishing and erecting the necessary hydrants, hose, etc.

I have had made a survey of the locality and find that the stream in question at times of low water furnishes about seventy gallons per minute and that by building a dam across the gorge about 2,200 feet north of the prison, a storage reservoir of 400,000 gallons can be obtained. I am, however, of the opinion that the amount appropriated is insufficient to accomplish the purpose sought, and estimate that even by using convict labor, as far as possible, the cost of materials, teaming and furnishing of such skilled labor as may not be obtainable from among the convicts will be $5,000. Upon the basis of this survey and estimate, after consultation with the prison authorities, I decided to defer any operations here until next year and would respectfully recommend a further appropriation of $1,500 for this work, so that when it is begun next spring it can be pushed forward at once to completion.

GENERAL RECOMMENDATIONS.

The adoption by so large a majority of the navigators of the canal of the system of moving boats in pairs, demonstrates the efficiency of the system of lengthened locks on the Erie canal, and the wisdom of the Legislature in initiating and continuing this improvement. During the present boating season with only seven out of the forty-five locks on this division lengthened, it is the exception rather than the rule to see a single boat moving along the canal, and I most earnestly urge a continuance of the policy so wisely begun, and so satisfactorily prosecuted until all the locks on this division west of lock No. 18 are lengthened. Four of the locks on this division will be lengthened during the coming winter, and on the opening of navigation in 1889, there will remain sixteen for the lengthening of which provision should be made. I estimate cost of lengthening one tier of each of these sixteen locks at $500,000.

Machinery for drawing in boats has been placed on the seven locks lengthened last winter and a contract based on similar plans has been let for the locks to be lengthened this winter.

An inspection of the operation of this machinery leads me to recommend a change of the adopted plan, by which the vertical spool shall be dispensed with and horizontal spool alone used, that better arrangements of rollers be applied to reduce the large amount of wear, by friction of the ropes, and that iron standards be substituted for the wooden frame. By making these changes we avoid the cutting and defacing of coping of lock now necessary to receive the vertical spool.

The wisdom of the system of testing cements now adopted on the canals was amply demonstrated by the work of last winter.

While some of the cements offered by the contractors failed to stand the tests required and were consequently rejected as being unfit for use, the proof was positive that most if not all of the manufacturers competing for the furnishing of cement for canal work, by a careful selection of the stone within their control and its proper manipulation in grinding, burning, etc., could and did furnish a satisfactory article.

It is of prime importance that all stone structures designed for retaining waters should have connections between stones made with a strong and water-proof substance, and, in my opinion, the best method of securing the furnishing of such by contractors, is a systematic and continued application of proper tests to all cements offered for use.

Nearly all of the locks on this division (except the extensions just completed) need repointing, and I am of the opinion that the cost necessarily incurred in the thorough pointing of these structures would be more than repaid by the increased life and efficacy given to them.

The fact that damage is often done to boats by running against the timber bulkheads of locks which are approached by sharp curves, more particularly among the sixteen locks forming the Cohoes ascent, leads me to recommend that a pile protection around bulkheads be placed at the head of those locks whose locations expose them to dangers of such accidents.

The continuing necessity of making surveys and maps for the use of the Attorney-General and of giving expert testimony before the Board of Claims in defense of suits brought against the State, and the fact that only on rare occasions can members of the ordinary engineering corps be detailed to such work without neglecting equally important duties in other directions, leads me to recommend that the Legislature be asked to repeat its action of last year and to make a special appropriation for this purpose, and also to repeat the recommendation heretofore made by both the State Engineer and Surveyor, and the Superintendent of Public Works that some provision be made to secure the drainage of private property damaged by leakage from the canals, which will cut off, or at least largely reduce, what is now a fruitful source of litigation against the State and of damage to its citizens.

ENGINEERING DEPARTMENT.

This division has been under the charge of John R. Kaley as division engineer, and of Chapman L. Johnson as resident engineer, from October 1, 1886, to January 15, 1888, and of Chapman L. Johnson as division engineer from January 16 to September 30, 1888, and John P. Kelly as resident engineer from February 1 to September 30, 1888.

The work of the department has been the making of surveys and preparations of maps, plans and estimates for the various works detailed in this report, the supervising of all contract work and the making of partial estimates and final accounts for the payments due to contractors, the making of surveys and maps and giving testimony in defense of State before the Board of Claims in all cases in which such work has been requested by the Attorney-General, and the giving of proper attention to all matters requiring the same, relating to the ordinary repairs of the canal.

A table is hereto appended giving the names, rank and compensation of all engineers employed on this division during the past fiscal year, with duration of the service of each and a summary of the total engineering expenditures. I have the honor to be

Very respectfully yours.

CHAPMAN L. JOHNSON,

Division Engineer.

Statement showing names, rank, number of days and compensation of Engineers employed on the Eastern Division of the New York State Canals, together with incidental expenses during the fiscal year ending September 30, 1888.

ORDINARY REPAIRS—ERIE CANAL.

Chapter 160, *Laws of* 1887.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.	Amount.
John R. Kaley	Division engineer	....	$2,400 00 per annum.	$498 63	$17 92	$516 55	
Chapman L. Johnson	Division engineer	....	2,400 00 per annum.	1,014 75	217 05	1,231 80	
Chapman L. Johnson	Resident engineer	70	2,000 00 per annum.	382 17	139 39	521 56	
John P. Kelly	Resident engineer	26	2,000 00 per annum.	142 08	7 60	149 68	
T. C. Leutze	Assistant engineer	12	5 00 per day	60 00	....	60 00	
T. J. Delaney	Leveler	52	4 50 per day	234 00	60	234 60	
C. M. Pepson	Rodman	64	3 50 per day	224 00	1 50	225 50	
L. L. Gaul	Rodman	254	3 50 per day	889 00	3 86	892 86	
F. W. Battershall	Rodman	39	3 50 per day	136 50	....	136 50	
Thomas Rattoone	Rodman	91	3 50 per day	318 50	....	318 50	
J. H. Jones	Chainman	37	2 50 per day	92 50	1 38	93 88	
J. A. Curran	Chainman	65	2 50 per day	162 50	....	162 50	
						$4,543 93	
Incidental Expenses.							
Labor					$122 00		
Stationery					92 59		
Postage and telegraph					123 32		
Miscellaneous					292 46		
						630 37	
							$5,174 30

Chapter 150, *Laws of* 1888.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.	Amount.
Chapman L. Johnson	Division engineer	....	$2,400 00 per annum.	$133 33	$67 02	$200 35	
John P. Kelly	Resident engineer	....	2,000 00 per annum.	114 76	14 12	128 88	
E. B. Noyes	Assistant engineer in charge	33	6 00 per day	198 00	52 51	250 51	
T. C. Leutze	Assistant engineer	16	5 00 per day	80 00	1 18	81 18	
H. M. Rood	Assistant engineer	20	5 00 per day	100 00	2 22	102 22	
G. V. Rapp	Leveler	36	4 50 per day	162 00	4 06	166 06	
T. J. Delaney	Leveler	34	4 50 per day	153 00	6 06	159 06	

C. M. Pepson	Rodman	39	3 50 per day	136 50	11 60	148 10	
F. W. Battershall	Rodman	22	3 50 per day	77 00	6 41	83 41	
William Miller	Chainman	14	2 50 per day	35 00	6 44	41 44	
J. A. Shanahan	Chainman	26	2 50 per day	65 00	....	65 00	
						$1,426 21	
Incidental expenses.							
Postage and telegraph					$3 08		
Miscellaneous					29 70		
						32 78	
							$1,458 99
Total for Erie canal							$6,633 29

ORDINARY REPAIRS — CHAMPLAIN CANAL.

(*Chapter* 160, *Laws of* 1887.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.	Amount.
John R. Kaley	Division engineer	....	$2,400 00 per annum.	$200 00	$49 43	$249 43	
Chapman L. Johnson	Division engineer	....	2,400 00 per annum.	483 33	64 18	547 51	
Chapman L. Johnson	Resident engineer	....	2,000 00 per annum.	200 00	56 93	256 93	
John P. Kelly	Resident engineer	....	2,000 00 per annum.	21 86	9 55	31 44	
A. S. Kibbe	Assistant engineer in charge	80	6 00 per day	480 00	31 26	511 26	
G. D. Baltimore	Assistant engineer in charge	10	5 00 per day	50 00	2 76	52 76	
W. J. Smith	Rodman	105	3 50 per day	367 50	5 27	372 77	
L. T. Carver	Rodman	80	3 50 per day	280 00	3 29	283 29	
J. C. Dougrey	Rodman	80	3 50 per day	280 00	5 58	285 58	
J. H. Jones	Rodman	4	3 50 per day	14 00	11 54	25 54	
Fred. Turner	Chainman	15	2 50 per day	37 50	1 86	39 36	
						$2,655 84	
Incidental Expenses.							
Postage and telegraph					$30 26		
Miscellaneous					146 19		
						176 45	
							$2,832 29
(*Chapter* 150, *Laws of* 1888.)							
Chapman L. Johnson	Division engineer	....	$2,400 00 per annum.	$66 67	$33 51	$100 18	
John P. Kelly	Resident engineer	....	2,000 00 per annum.	98 36	1 85	100 21	
A. S. Kibbe	Assistant engineer in charge	3	6 00 per day	18 00	....	18 00	
H. M. Rood	Assistant engineer	18	5 00 per day	90 00	1 20	91 20	
C. M. Pepson	Rodman	12	3 50 per day	42 00	3 45	45 45	
L. L. Gaul	Rodman	25	3 50 per day	87 50	9 85	97 35	
W. J. Smith	Rodman	14	3 50 per day	49 00	1 98	50 98	
William Miller	Chainman	2	2 50 per day	5 00	3 25	8 25	
J. A. Shanahan	Chainman	10	2 50 per day	25 00	....	25 00	
						$536 62	
Incidental Expenses.							
Labor					$16 00		
Stationery					11 40		
Postage and telegraph					20 99		
						48 39	
							585 01
Total for Champlain canal							$3,417 30

EXTRAORDINARY REPAIRS — ERIE CANAL.

Chapter 113, *Laws of* 1887.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. P. Kelly	Resident engineer	....	$2,000 00 per annum.	$551 91	$170 44	$722 35
J. P. Kelly	Assistant engineer in charge	90	6 00 per day	540 00	89 46	629 46
Martin Schenck	Assistant engineer in charge	182	6 00 per day	1,092 00	123 61	1,215 61
E. B. Noyes	Assistant engineer in charge	139	6 00 per day	834 00	106 06	940 06
H. M. Rood	Assistant engineer	194	5 00 per day	970 00	21 05	991 05
T. C. Leutze	Assistant engineer	106	5 00 per day	530 00	16 77	546 77
T. C. Leutze	Leveler	60	4 50 per day	270 00	2 32	272 32
G. V. Rapp	Leveler	196	4 50 per day	891 00	100 28	991 28
T. J. Delaney	Leveler	196	4 50 per day	891 00	28 12	919 12
A. P. Folwell	Leveler	195	4 50 per day	886 50	24 48	910 98
R. C. Strachen	Leveler	145	4 50 per day	652 50	9 54	662 04
L. L. Gaul	Rodman	45	3 50 per day	157 50	18 36	175 86
C. M. Pepson	Rodman	127	3 50 per day	444 50	26 52	471 02
Thomas Rattoone	Rodman	91	3 50 per day	318 50	....	318 50
F. W. Battershall	Rodman	133	3 50 per day	465 50	12 10	477 60
C. H. Barber	Rodman	156	3 50 per day	546 00	16 45	562 45
James Ryan, Jr.	Rodman	53	3 50 per day	185 50	13 98	199 48
John Hickey	Rodman	174	3 50 per day	609 00	133 75	742 75
G. T. DeForest	Rodman	137	3 50 per day	476 00	48 62	524 62
J. H. Jones	Rodman	134	3 50 per day	469 00	30 59	499 59
J. H. Jones	Chainman	13	2 50 per day	32 50	2 60	35 10
G. T. De Forest	Chainman	13	2 50 per day	32 50	7 28	39 78
J. A. Curran	Chainman	175	2 50 per day	437 50	....	437 50
J. T. Gaffney	Chainman	178	2 50 per day	445 00	37 72	482 72
Wm. Miller	Chainman	178	2 50 per day	445 00	23 96	468 96
E. J. Waldron	Chainman	169	2 50 per day	422 50	32 99	455 49
J. A. Shanahan	Chainman	157	2 50 per day	392 50	34 73	427 23
W. A. O'Brien	Chainman	134	2 50 per day	335 00	10 30	345 30
						$15,464 99
			Incidental expenses.			
Stationery					$317 98	
Postage and telegraph					127 36	
Miscellaneous					671 71	
						1,117 05
						$16,582 04

EXTRAORDINARY REPAIRS — CHAMPLAIN CANAL.

Chapter 113, *Laws of* 1887.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. P. Kelly	Resident engineer	....	$2,000 00 per annum,	$87 43	$26 02	$113 45
E. B. Noyes	Assistant engineer in charge	8	6 00 per day	48 00	18 87	66 87
A. S. Kibbe	Assistant engineer in charge	179	6 00 per day	1,074 00	144 76	1,218 76
A. S. Kibbe	Assistant engineer	8	5 00 per day	40 00	....	40 00
G. D. Baltimore	Assistant engineer	111	5 00 per day	555 00	20 36	575 36
L. L. Gaul	Rodman	7	3 50 per day	24 50	2 81	27 31
F. W. Battershall	Rodman	52	3 50 per day	182 00	15 62	197 62
W. J. Smith	Rodman	105	3 50 per day	367 50	29 75	397 25
L. T. Carver	Rodman	122	3 50 per day	427 00	18 74	445 74
J. C. Dougrey	Rodman	123	3 50 per day	430 50	32 13	462 63
J. C. Dougrey	Chainman	62	2 50 per day	155 00	14 85	169 85
L. T. Carver	Chainman	62	2 50 per day	155 00	8 22	163 22
G. T. De Forest	Chainman	49	2 50 per day	122 50	5 27	127 77
William Miller	Chainman	49	2 50 per day	122 50	5 32	127 82
W. A. O'Brien	Chainman	49	2 50 per day	122 50	8 91	131 41
Fred. Turner	Chainman	127	2 50 per day	317 50	9 95	327 45
						$4,592 51
	Incidental expenses.					
Postage and telegraph					$35 98	
Stationery					31 80	
Miscellaneous					898 22	
						966 00
						$5,558 51

EXTRAORDINARY REPAIRS — ERIE CANAL.

Chapter 416, *Laws of* 1888.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. P. Kelly	Resident engineer	....	$2,000 00 per annum.	$120 22	$4 41	$124 63
T. C. Leutze	Assistant engineer	47	5 00 per day	235 00	27 16	262 16
G. V. Rapp	Leveler	3	4 50 per day	13 50	7 56	21 06
C. M. Pepson	Rodman	15	3 50 per day	52 50	18 61	71 11
F. W. Battershall	Rodman	33	3 50 per day	115 50	13 14	128 64
C. H. Barber	Rodman	6	3 50 per day	21 00	13 34	34 34
J. H. Jones	Rodman	3	3 50 per day	10 50	7 82	18 32
G. T. DeForest	Rodman	2	3 50 per day	7 00	3 54	10 54
William Miller	Chainman	2	2 50 per day	5 00	3 61	8 61
						$679 41
Incidental expenses.						
Stationery					$51 46	
Postage and telegraph					1 06	
Miscellaneous					60 79	113 31
						$792 72

CHAMPLAIN CANAL.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. P. Kelly	Resident engineer	....	$2,000 00 per day	$43 72	$6 64	$50 36
E. B. Noyes	Assistant engineer in charge	45	6 00 per day	270 00	46 04	316 04
T. C. Leutze	Assistant engineer	7	5 00 per day	35 00	....	35 00
H. M. Rood	Assistant engineer	32	5 00 per day	160 00	11 94	171 94
T. J. Delaney	Leveler	19	4 50 per day	85 50	1 80	87 30
F. W. Battershall	Rodman	21	3 50 per day	73 50	....	73 50
L. T. Carver	Rodman	44	3 50 per day	154 00	21 02	175 02
J. C. Dougrey	Rodman	45	3 50 per day	157 50	19 02	176 52
J. A. Shanahan	Chainman	42	2 50 per day	105 00	7 67	112 67
						$1,198 35
Incidental expenses.						
Stationery					$24 54	
Postage and telegraph					8 12	
Miscellaneous					142 80	175 46
						$1,373 81

DREDGING ALBANY BASIN.

Chapter 416, *Laws of* 1888.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. P. Kelly	Resident engineer	....	$2,000 00 per annum.	$60 11	....	$60 11
T. C. Leutze	Assistant engineer	16	5 00 per day	80 00	....	80 00
T. C. Leutze	Assistant engineer in charge	14	6 00 per day	84 00	....	84 00
C. M. Pepson	Rodman	13	3 50 per day	45 50	....	45 50
F. W. Battershall	Rodman	12	3 50 per day	42 00	....	42 00
William Miller	Chainman	20	2 50 per day	50 00	....	50 00
E. J. Waldron	Chainman	24	2 50 per day	60 00	....	60 00
						$421 61
Incidental Expenses.						
Stationery					$7 92	
Miscellaneous					21 46	29 38
						$450 99

SHIP STREET BRIDGE, COHOES — CHAMPLAIN CANAL.

Chapter 168, *Laws of* 1887, *and Chapter* 126, *Laws of* 1888.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. P. Kelly	Resident engineer	....	$2,000 00 per annum.	$32 78	$6 00	$38 78
C. M. Pepson	Rodman	11	3 50 per day	38 50	10 50	49 00
F. W. Battershall	Rodman	2	3 50 per day	7 00	2 00	9 00
William Miller	Chainman	4	2 50 per day	10 00	4 00	14 00
						$110 78

FOR MAKING SURVEYS FOR CLAIMS BEFORE THE STATE BOARD OF CLAIMS.

Chapter 249, *Laws of* 1888.

ERIE CANAL.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.	Amount.
T. C. Leutze	Assistant engineer	7	$5 00 per day	$35 00	$12 63	$47 63	
C. M. Pepson	Rodman	2	3 50 per day	7 00	6 27	13 27	
W. J. Smith	Rodman	3	3 50 per day	10 50	5 27	15 77	
William Miller	Chainman	3	2 50 per day	7 50	6 52	14 02	
Miscellaneous						5 90	$96 59
CHAMPLAIN CANAL.							
J. P. Kelly	Resident engineer	3	$2,000 00 per annum.	$16 39	$0 60	$16 99	
T. C. Leutze	Assistant engineer	8	5 00 per day	40 00	....	40 00	
C. M. Pepson	Rodman	4	3 50 per day	14 00	3 50	17 50	
W. J. Smith	Rodman	3	3 50 per day	10 50	2 90	13 40	
William Miller	Chainman	4	2 50 per day	10 00	3 25	13 25	
Miscellaneous						65	101 79
Total							$198 38

The above tables are summarized as follows:

ORDINARY REPAIRS.			
Erie canal	$6,633 29		
Champlain canal	3,417 30		$10,050 59
EXTRAORDINARY REPAIRS.			
Lengthening locks Erie canal, chapter 113, Laws of 1887	$16,582 04		
Improvement Champlain canal, chapter 113, Laws of 1887	5,558 51		
		$22,140 55	
Lengthening locks Erie canal, chapter 416, Laws of 1888	$792 72		
Dredging Albany basin, chapter 416, Laws of 1888	450 99		
Improvement Champlain canal, chapter 416, Laws of 1888	1,373 81		
		2,617 52	
Ship street bridge, Cohoes, chapter 168, Laws of 1887		110 78	
			24,868 85
SPECIAL SURVEYS.			
Surveys for claims before the State Board of Claims, chapter 249, Laws of 1888			198 38
			$35,117 82

TABLE OF CONTRACTS, ON EASTERN DIVISION, COMPLETED DURING THE YEAR ENDING SEPTEMBER 30, 1888.

ERIE CANAL.

NAMES OF CONTRACTORS.	Date of contract.	Character of work.	LEGISLATIVE ACT.		Appropriation.	Engineer's estimate at contract prices.*	Final estimate.	Remarks.
			Chapter.	Year.				
Clinton Beckwith	July 11, 1887	Lengthening at foot, lock No. 31	113	1887		$20,315 50	$18,599 12	
Soule & Raynor	July 9, 1887	Lengthening at foot, lock No. 32	113	1887		23,432 50	22,098 84	
Soule & Raynor	July 9, 1887	Lengthening at foot, lock No. 33	113	1887	$375,000 00	24,387 50	24,354 87	No piles driven.
Leavey & Buckley	Aug. 12, 1887	Lengthening at foot, lock No. 34	113	1887	for	23,942 00	21,739 03	No piles driven.
McLean & Rockwell	Aug. 19, 1887	Lengthening at foot, lock No. 35	113	1887	15 locks.	22,173 00	21,586 50	
Daniel Ford	July 8, 1887	Lengthening at foot, lock No. 44	113	1887		27,163 35	25,882 10	
John Moore	July 11, 1887	Lengthening at foot, lock No. 45	113	1887		27,240 25	28,592 39	Increased number of piles driven.
Soule & Raynor	March 10, 1888	Substructure for lift-bridge at Fort Plain	311	1887	$7,500 00	2,004 05	1,859 66	
Hilton Bridge Construction Co	March 27, 1888	Superstructure for lift-bridge at Fort Plain	311 30	1887 1888	2,500 00	6,810 00	7,295 00	
Soule & Raynor	March 10, 1888	Waste-weir west of lock No. 33	Ordinary.	Repairs	....	1,941 00	1,885 95	
Wm. B. Wemple's Sons	March 29, 1888	Machinery on locks Nos. 31, 32, 33, 34, 44 and 45	Ordinary.	Repairs	....	10,500 00	10,539 50	
Totals						$189,909 15	$184,432 96	

CHAMPLAIN CANAL.

Sherman & McDonough.	Sept. 27, 1887 ...	Improving 2,100 ft. north of Wilber's basin	113	1887	$70,000 00	$8,982 70	$9,075 08	Additional vertical wall built on berme side.
John W. Whalen.........	Oct. 3, 1887 ...	Improving 2,000 ft. south of bridge No. 97	113	1887		16,233 75	13,093 42	Work shortened up.
John W. Whalen.........	Oct. 3, 1887 ...	Improving 7,900 ft. south of bridge No. 104	113	1887		22,466 50	20,594 43	Work shortened up.
Sherman & McDonough.	Sept. 27, 1887 ...	Improving 1,800 ft. north of bridge No. 104	113	1887		16,079 52	14,602 98	Work shortened up.
Swan & Riley.............	April 2, 1888 ...	Building 290 ft. of vertical wall on Glens Falls feeder	113	1887	....	1,909 00	1,371 00	
Swan & Riley.............	April 2, 1888 ...	Building 290 ft. of vertical wall on Glens Falls feeder	441	1886	....		684 83	
Totals						$65,671 47	$59,421 24	

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* Figures in this column are obtained by deducting from footing of contractor's bid the estimated value of old material to be used as same appears in engineer's preliminary estimate.

TABLE OF CONTRACTS PENDING, ON THE EASTERN DIVISION, ON THE 30TH DAY OF SEPTEMBER, 1888.

ERIE CANAL.

NAMES OF CONTRACTORS.	Date of contract.	Character of work.	LEGISLATIVE ACT.		Appropriation.	Engineer's preliminary estimate.	Engineer's estimate at contract prices.
			Chap.	Year.			
Costello, Neagle & Co...........	Aug. 27, 1888	Lengthening at foot, lock No. 27........	416	1888	$200,000 for 7 l'ks	$24,492 00	$24,356 00
Costello, Neagle & Co...........	Aug. 27, 1888	Lengthening at foot, lock No. 28........	416	1888		26,768 00	26,595 00
Whalen Bros	Aug. 27, 1888	Lengthening at foot, lock No. 29........	416	1888		25,379 50	24,529 00
Hughes Bros..........................	Aug. 27, 1888	Lengthening at foot, lock No. 30........	416	1888		33,238 00	32,851 65
Nicholas & Wm. H. Wemple....	Aug. 18, 1888	Placing machinery on locks 27, 28, 29, 30	416	1888		5,200 00	4,400 00
J. Van Patten & Co	Aug. 29, 1888	Dredging Albany basin	416	1888	$40,000	25c. per cu. y'd	24¼c. per cu. y'd
Andrew Kinnum	Sept. 21, 1887	Improving Mill creek, Schenectady....	635 133	1887 1888	10,000	$11,323 00	$9,000 00

CHAMPLAIN CANAL.

NAMES OF CONTRACTORS.	Date of contract.	Character of work.	Chap.	Year.	Appropriation.	Engineer's preliminary estimate.	Engineer's estimate at contract prices.
James E. Flood	July 8, 1888	Substructure of Ship St. bridge, Cohoes	168 126	1887 1888	$8,000	$6,156 00	$5,754 60
Hilton Bridge Construction Co.	July 23, 1888	Superstructure of Ship St. b'dge, Cohoes	168 126	1887 1888		1,800 00	1,868 00

Table of Locks — Erie Canal — Eastern Division.

NUMBER.	Distances.		Lift in feet.
	Lock to lock.	From Albany.	
1	....	....	15.159
2	98 chains 83 links	1.24 miles	9.495
3	419 chains 16 links	6.48 miles	11.169
4	25 chains 17 links	6.80 miles	11.380
5	21 chains 90 links	7.07 miles	10.597
6	16 chains 52 links	7.28 miles	10.073
7	10 chains 61 links	7.41 miles	9.931
8	12 chains 86 links	7.57 miles	10.545
9	26 chains 53 links	7.90 miles	9.408
10	14 chains 58 links	8.08 miles	10.362
11	12 chains 91 links	8.24 miles	9.621
12	11 chains 66 links	8.39 miles	9.986
13	16 chains 5 links	8.59 miles	10.345
14	17 chains 9 links	8.80 miles	10.032
15	21 chains 53 links	9.07 miles	9.833
16	15 chains 20 links	9.26 miles	10.045
17	25 chains 39 links	9.58 miles	10.287
18	15 chains 44 links	9.77 miles	10.249
19	708 chains 42 links	18.63 miles	8.441
20	219 chains 29 links	21.37 miles	10.418
21	257 chains 90 links	24.59 miles	11.126
22	14 chains 1 link	24.77 miles	11.609
23	553 chains 43 links	31.69 miles	8.318
24	63 chains 7 links	32.47 miles	8.191
25	303 chains 87 links	36.27 miles	7.716
26	510 chains 59 links	42.66 miles	8.365
27	16 chains 8 links	42.86 miles	7.886
28	417 chains 16 links	48.07 miles	7.723
29	157 chains 20 links	50.04 miles	7.399
30	50 chains 60 links	50.67 miles	10.213
31	1108 chains 34 links	64.52 miles	5.867
32	505 chains 62 links	70.84 miles	8.126
33	408 chains 77 links	75.95 miles	5.704
34	205 chains 63 links	78.52 miles	8.483
35	254 chains 23 links	81.70 miles	7.785
36	349 chains 20 links	86.07 miles	10.019
37	49 chains 52 links	86.68 miles	9.898
38	12 chains 87 links	86.85 miles	8.733
39	17 chains 35 links	87.06 miles	10.524
40	220 chains 82 links	89.82 miles	8.524
41	211 chains 11 links	92.46 miles	8.286
42	228 chains 99 links	95.32 miles	7.954
43	20 chains 59 links	95.58 miles	8.069
44	216 chains 16 links	98.28 miles	10.737
45	98 chains 62 links	99.52 miles	11.172
45 to county line	537 chains 67 links	106.24 miles	....

In addition to the above table are the following:

Two double locks at West Troy side-cut; two single locks at Port Schuyler side-cut; one weigh-lock at Albany; one weigh-lock at West Troy.

TABLE OF AQUEDUCTS — ERIE CANAL — EASTERN DIVISION.

Number.	NAME.	Location, distance west of lock.	Interior width.	Number of spans.	Total length.
1	Lower Mohawk	220 chains 52 links west of lock 18	40 ft. 6 in.	26	17 chains 23 links
2	Upper Mohawk	6 chains 60 links west of lock 22	44 ft. 4 in.	14	9 chains 25 links
3	Flat Stone creek	113 chains 97 links west of lock 24	49 ft.	3	1 chain 13 links
4	Sansai Kill	171 chains 9 links west of lock 25	52 ft.	4	1 chain 55 links
5	Schoharie creek	8 chains 97 links west of lock 30	40 ft. 6 in.	14	9 chains 46 links
6	Tokkon creek	664 chains 91 links west of lock 30	51 ft. 4 in.	4	1 chain 53 links
7	Yatesville	846 chains 38 links west of lock 30	51 ft.	4	1 chain 53 links
8	Lasher's	934 chains 92 links west of lock 30	50 ft.	3	1 chain 13 links
9	Platt Kill (Sprakers)	5 chains 77 links west of lock 31	50 ft.	5	1 chain 94 links
10	Bauman's creek (Canajoharie)	251 chains 97 links west of lock 31	50 ft.	5	1 chain 94 links
11	Otsquago creek (Fort Plain)	18 chains 31 links west of lock 32	50 ft.	5	1 chain 91 links
12	Castle creek (Indian Castle)	7 chains 1 link west of lock 35	50 ft. 6 in.	5	1 chain 94 links
13	Fulmer's creek (Mohawk)	2 chains 72 links west of lock 43	65 ft. 6 in.	3	1 chain 12 links
14	Ilion	129 chains 36 links west of lock 43	51 ft. 6 in.	2	74 links
15	Moyer creek	2 chains 74 links west of lock 45	66 ft.	2	74 links
16	Ferguson's creek	452 chains 35 links west of lock 45	55 ft.	1	33 links

TABLE OF WASTE-WEIRS — ERIE CANAL — EASTERN DIVISION.

Number.	LOCATION.	Number valves.	Size of valves.	Length of spillway.	Remarks.
1	308.30 chains west lock 1	4	2 ft. 6 in. × 3 ft	33 ft. less ten 1-foot posts......	
2	Under approach, bridge 15	7	3 ft. × 2 ft	26 ft	
3	2.50 chains east lock 4	4	2 ft. × 2 ft	29 ft	
4	4.00 chains east lock 10	2	3 ft. × 3 ft	14 ft	
5	18.40 chains west lock 18	4	3 ft. 6 in. × 3 ft	28 ft. 6 in	
6	12.20 chains west lock 20	4	2 ft. × 2 ft. 6 in.	17 ft	
7	368.46 chains west lock 22	4	2 ft. × 2 ft. 6 in.	12 ft	
8	163.84 chains west lock 27	3	4 ft. × 3 ft	11 ft. less two 1-foot posts......	
9	1,097.09 chains west lock 30	4	3 ft. × 2 ft. 6 in.	12 ft	
10	6.50 chains west lock 33	3	2 ft. 9 in. × 2 ft. 9 in.	17 ft. 7 in. less four 10-in. posts.	Bot. opening C. B+3.0.
11	20.00 chains west lock 33	3	2 ft. 9 in. × 2 ft. 9 in.	10 ft. less two 10-in. posts......	
12	286.02 chains west lock 35	5	2 ft. × 2 ft. 6 in.	13 ft. 6 in	
13	2.50 chains west lock 36	2	5 ft. 6 in. × 2 ft. 6 in.	11 ft. 6 in	Bot. opening C. B.+4.92.
14	16.52 chains west lock 39	2	4 ft. × 2 ft. 6 in.	60 ft	
15	13.02 chains west lock 40	...	....	12 ft	No gates; not in use.
16	10.64 chains west lock 41	4	2 ft. 6 in. × 2 ft. 2 in.	75 ft	
17	18.32 chains west lock 42	...	....	....	Filled up; not in use.

TABLE SHOWING BRIDGES ON THE ERIE CANAL, WITH THEIR LOCATION, SPAN AND STYLE OF SUPERSTRUCTURE.

On level between locks 1 *and* 2 — 98.83 *chains.*

Number.	NAME.	LOCATION OF CENTER LINE. West of Lock 1. Chains.	LOCATION OF CENTER LINE. West of Lock 1. Links.	Character of truss.	MEAN CLEAR SPAN. Feet.	MEAN CLEAR SPAN. Inches.
1	Water street, Albany	...	....	Whipple, cast-iron, arch	48	0
2	Lawrence street, Albany	11	58	Warren, wrought-iron, riveted, swing	109	4
3	Ferry street, Albany	16	73	Whipple, cast-iron, trapezoidal	111	4
4	Exchange street, Albany	53	62	Wrought-iron, riveted, arch	77	5
	Erie street, Albany	82	90	Suspension (foot)	....	.....

On level between locks 2 *and* 3 — 419.60 *chains.*

Number.	NAME.	West of Lock 2. Chains.	West of Lock 2. Links.	Character of truss.	Feet.	Inches.
5	Farm	47	67	Whipple, wooden	71	3
	Delaware and Hudson railroad	....	....	Wrought-iron, riveted, trapezoidal	....	.....
6	Road	114	14	Whipple, wooden	71	3
7	Menands road	134	63	Whipple, cast-iron, arch	78	1
8	Road	157	21	Whipple, wooden	82	0
9	Road	186	21	Whipple, combination	83	4
10	Street, West Troy	215	44	Whipple, combination	82	5
11	Spring street, West Troy	243	54	Whipple, combination	77	0
12	Middle street, West Troy	251	42	Trapezoidal, wrought-iron, riveted, foot	91	0
13	Mansion street, West Troy	260	97	Whipple, combination	82	10
14	Street, West Troy	269	2	Warren, wrought-iron, riveted	98	8
	United States arsenal road	290	00	Towne, wooden lattice, covered	....	.....
	United States arsenal road	302	00	Cast-iron pipe, arch	....	.....
15	Schenectady street, West Troy	312	57	Whipple, cast-iron, arch	90	11
16	Ferry street, West Troy	320	93	Whipple, cast-iron, arch	81	0
17	Central avenue, West Troy	339	03	Wrought-iron pipe, arch	84	6

18	Genesee street, West Troy	350	34	Whipple, cast-iron, arch	82	11
19	Change, West Troy	363	38	Wrought-iron pipe, arch	94	7
20	Union street, West Troy	365	69	Cast-iron pipe, arch	80	0
21	Auburn street, West Troy	379	99	Whipple, cast-iron, arch	81	4
	N. Y. C. and D. and H. railroads	401	21	Warren, wrought-iron, riveted	....	.....
22	Road and change	415	45	Whipple, trapezoidal	119	9
	On level between locks 3 and 4 — 25.17 chains.					
	West of Lock 3.					
	Delaware and Hudson railroad	22	67	Wrought-iron, riveted, triangular	....	.....
	On level between locks 4 and 5 — 21.90 chains.					
	West of Lock 4.					
23	Road	3	....	Towne, wooden lattice, covered	110	5
	On level between locks 8 and 9 — 26.53 chains.					
	West of Lock 8.					
24	Highland avenue, Cohoes	21	50	Whipple, cast-iron, arch	110	2
	On level between locks 12 and 13 — 16.05 chains.					
	West of Lock 12.					
25	Columbia avenue, Cohoes	8	....	Whipple, cast-iron, arch	110	10
	On level between locks 13 and 14 — 17.09 chains.					
	West of Lock 13.					
26	High street, Cohoes	8	....	Whipple, cast-iron, trapezoidal	110	0
	On level between locks 15 and 16 —15.20 chains.					
	West of Lock 15.					
27	Vliet street, Cohoes	11	20	Whipple, cast-iron, trapezoidal	120	0
	On level between locks 17 and 18—15.44 chains.					
	West of Lock 17.					
28	Farm	11	44	Whipple, combination	99	6

TABLE SHOWING BRIDGES ON THE ERIE CANAL, WITH THEIR LOCATION, ETC. — (*Continued*).
On level between locks 18 *and* 19—708.42 *chains.*

Number.	NAME.	LOCATION OF CENTER LINE.		Character of truss.	MEAN CLEAR SPAN.	
		West of Lock 18.			Feet	Inches.
		Chains.	Links.			
29	Road and change	14	00	Whipple, cast-iron, arch	80	4
	Private foot	20	30	Suspension	....	.....
30	Cement mill farm	57	22	Whipple, wooden	72	3
31	Fundy farm	128	28	Whipple, wooden	72	7
32	Farm	169	21	Whipple, wooden	70	6
33	Aqueduct road and change	218	8	Whipple, cast-iron, arch	72	2
34	Crescent road	244	30	Whipple, combination	86	4
	Private foot	250	67	Suspension	....	.....
	Noxon dry dock, private	251	6	Road draw	....	.....
	Private foot	274	80	Suspension	....	.....
	Private foot	303	80	Suspension	....	.....
	Private foot	315	30	Suspension	....	.....
35	Newton farm	340	21	Whipple, wooden	71	11
36	Wonderford farm	369	14	Whipple, wooden	71	7
37	Dunsback farm	432	46	Whipple, wooden	72	0
38	Clute road	512	10	Whipple, combination	88	8
39	Clute farm	521	17	Whipple, combination	70	2
40	Pearse farm	543	70	Whipple, wooden	70	10
41	Van Vranken farm	568	9	Whipple, combination	71	11
42	Whitehead dock road	598	59	Wrought-iron, pin connection	69	11
43	Clute farm	633	80	Whipple, combination	70	4
44	Pearse farm	642	27	Whipple, wooden	72	8
45	Van Vranken farm	658	55	Whipple, wooden	71	8
46	McDermott farm	693	57	Whipple, wooden	73	0

	On level between locks 19 *and* 20—219.29 *chains.*					
	West of Lock 19.					
47	Vischer's Ferry road	69	70	Whipple, combination	74	0
	On level between locks 20 *and* 21—257.90 *chains.*					
	West of Lock 20.					
48	Funda's basin road	108	92	Whipple, combination	72	8
49	Towpath bridge over feeder	255	30	Whipple, wooden	44	0
	On level between locks 21 *and* 22—14.01 *chains.*					
	West of Lock 21.					
	Private road (over slip)	9	46	Wooden	25	0
50	Road and change, Rexford Flats	12	24	Wrought iron, riveted, arch	93	2
	On level between locks 22 *and* 23—553.43 *chains.*					
	West of Lock 22.					
51	Aqueduct road	24	47	Whipple, combination	72	5
52	Vedder farm	143	4	Whipple, combination	72	3
53	Cunningham farm	161	80	Whipple, combination	71	0
	D. and H. railroad	214	00	Wrought-iron, riveted, lattice	...	.....
54	Freeman road	230	28	Whipple, combination	72	9
55	Road	265	00	Whipple wooden	79	3
	Front street, Schenectady	284	49	Wrought-iron, riveted, triangular, swing	124	0
56	Jefferson street, Schenectady	305	2	Whipple, combination	80	8
57	Green street, Schenectady	311	56	Whipple, cast-iron, arch	91	4
	N. Y. C. railroad	319	10	Wrought-iron, riveted, lattice	....	.....
58	Union street, Schenectady	323	98	Whipple, cast-iron, arch	90	0
59	Liberty street, Schenectady	331	46	Wrought-iron, riveted, arch	80	6
60	State street, Schenectady	337	72	Wrought-iron, riveted, trapezoidal	73	6
61	Church street, Schenectady	354	24	Whipple, combination	72	0
62	Rotterdam street, Schenectady	366	7	Whipple, combination	77	9
63	Navarine Bay farm	504	50	Whipple, combination	69	10

TABLE SHOWING BRIDGES ON THE ERIE CANAL, WITH THEIR LOCATION, ETC.—(*Continued*).

On level between locks 23 *and* 24 — 63.07 *chains.*

Number.	NAME.	LOCATION OF CENTER LINE. West of Lock 23		Character of truss.	MEAN CLEAR SPAN.	
		Chains.	Links.		Feet.	Inches.
64	Schermerhorn farm	9	1	Wrought-iron, arch	70	9
	On level between locks 24 *and* 25 — 303.87 *chains.*	West of Lock 24.				
65	Becker's road	49	83	Whipple, combination	79	0
66	Van Slyke road	99	38	Whipple, combination	81	7
	Private farm	126	50	Whipple, wooden	82	6
67	Crawford road	181	54	Whipple, combination	77	6
68	Farm	218	15	Whipple, combination	70	4
69	Bradt's farm	294	47	Whipple, wooden	71	6
	Fitchburg railroad	....	....	Wrought-iron, riveted, trapezoidal	....	.....
	On level between locks 25 *and* 26 — 510.59 *chains.*	West of Lock 25.				
70	Clute farm	9	38	Whipple, combination	71	5
71	Turnbull farm	40	38	Whipple, combination	70	11
72	Farm	74	89	Whipple, wooden	70	3
73	Road	117	58	Warren, wrought-iron, riveted	78	4
74	Patterson road	185	89	Whipple, combination	71	0
	Private farm	365	3	Whipple, wooden	89	0
75	French farm	398	64	Whipple, combination	72	10
76	Farm	460	10	Whipple, wooden	75	3

	On level between locks 26 *and* 27 — 16.08 *chains.*					
	West of Lock 26.					
77	Phillips farm	12	67	Whipple, combination	86	10
	On level between locks 27 *and* 28 — 417.16 *chains.*					
	West of Lock 27.					
78	River street, Port Jackson	203	20	Whipple, cast-iron, arch	72	8
79	Bridge street, Port Jackson	211	32	Whipple, cast-iron, arch	75	5
	On level between locks 28 *and* 29 — 157.20 *chains.*					
	West of Lock 28.					
80	Voorhees farm	138	11	Whipple, wooden	70	9
	On level between locks 29 *and* 30 — 50.60 *chains.*					
	West of Lock 29.					
81	Farm	30	11	Whipple, wooden	83	10
82	Fort Hunter road	49	81	Whipple, cast-iron, arch	97	4
	On level between locks 30 *and* 31 — 1,108.34 *chains*					
	West of Lock 30.					
83	Hudson farm	51	75	Whipple, wooden	71	2
84	Auriesville road	123	44	Whipple, wooden	82	10
85	Auriesville farm	152	39	Whipple, wooden	83	7
86	Voorhees farm	181	20	Whipple, wooden	71	0
87	Coon farm	219	80	Whipple, wooden	86	5
88	Quackenbush farm	253	48	Whipple, wooden	69	4
89	County house road	280	71	Wrought-iron, riveted, trapezoidal	81	0
90	Vrooman farm	306	17	Whipple, wooden	70	0
91	Sandy Hill road	345	12	Whipple, combination	68	0
92	Canal street, Fultonville	393	70	Wrought-iron, riveted, trapezoidal	70	7
	Dry dock (road)	398	11	Wooden (on berme)	24	6
93	Main street, Fultonville	412	02	Whipple, cast-iron, arch	72	8
94	Steam mill, Fultonville	421	07	Whipple, cast-iron, arch	75	9
95	Snyder farm	482	77	Whipple, wooden	71	4

TABLE SHOWING BRIDGES ON THE ERIE CANAL, WITH THEIR LOCATION, ETC.—(*Continued*).

On level between locks 30 *and* 31 — 1,108.34 *chains.*

Number.	NAME.	LOCATION OF CENTER LINE.		Character of truss.	MEAN CLEAR SPAN.	
		West of Lock 30			Feet.	Inches.
		Chains.	Links.			
96	Sturm farm	538	53	Whipple, wooden	71	11
97	Printy farm	612	63	Whipple, wooden	71	0
98	Yates farm	737	00	Whipple, wooden	71	4
99	Downing farm	83	63	Whipple, wooden	71	3
100	M. Yates farm	828	13	Whipple, wooden	71	0
101	A. Yates farm	928	63	Whipple, wooden	71	0
	Downing road	941	15	Wrought iron, rivet and pin, trapezoidal	93	0
	Downing road	1,023	15	Wrought-iron, rivet and pin, trapezoidal	101	6
102	Mitchell farm	1,079	20	Whipple, wooden	70	0
	On level between locks 31 *and* 32 — 505.62 *chains,*					
		West of Lock 31.				
103	Sprakers road	5	9	Whipple, wooden	70	0
104	Ferry street, Sprakers	17	64	Whipple, cast-iron arch	70	2
105	Van Every farm	49	14	Whipple, wooden	71	8
106	Kelley farm	82	78	Whipple, wooden	70	8
107	A. Van Alstine farm	142	44	Whipple, wooden	70	9
108	L. Van Alstyne farm	205	77	Whipple, wooden	71	4
109	Bullock farm	241	87	Whipple, wooden	69	8
110	Canajoharie, street	259	92	Whipple, cast-iron arch	82	1
	Private foot	285	50	Suspension	....	.....
111	Allen farm	314	26	Whipple, wooden	71	0

112	Wagner farm	370	46	Whipple, wooden	70	2
113	Nellis farm	475	54	Whipple, wooden	72	3
	West Shore railroad	....	....	Wrought-iron pin, trapezoidal	....	.....

On level between locks 32 *and* 33 — 408.77 *chains*

West of Lock 32.

114	Morell farm	10	95	Whipple, wooden	71	1
	Lift bridge, Main street	22	62	Wrought-iron, riveted, trapezoidal truss	97	10
115	Foot, Fort Plain	22	95	Suspension	147	0
116	River street, Fort Plain	28	21	Cast-iron pipe arch	71	8
117	Clark farm	59	64	Whipple, wooden	71	11
118	Lipe farm	89	99	Whipple, wooden	70	7
	West Shore railroad	....	....	Wrought-iron, pin, trapezoidal	....	.....
	Private farm	242	65	Whipple, wooden	....	.....
119	Smith farm	337	28	Whipple, wooden	71	10

On level between locks 33 *and* 34 — 205.63 *chains.*

West of Lock 33.

120	Powell farm	23	79	Whipple, wooden	71	7
121	Cox road	66	3	Whipple, combination	82	5
122	Abandoned road	175	83		....	.....
123	Crounse farm	196	10	Whipple, wooden	71	4

On level between locks 34 *and* 35 — 254.23 *chains.*

West of Lock 34.

124	Mindenville road	8	19	Whipple, combination	72	5
125	Brazee farm	45	50	Whipple, combination	85	1
126	Snell farm	71	69	Whipple, combination	71	2
127	East creek landing, road	94	17	Whipple, combination	71	0
128	Smith farm	128	45	Whipple, wooden	71	9
129	Van Alstine farm	174	8	Whipple, wooden	71	9
130	Jones farm	217	51	Whipple, combination	70	7
131	Green farm	241	53	Whipple, combination	70	0

TABLE SHOWING BRIDGES ON THE ERIE CANAL, WITH THEIR LOCATION, ETC.—(*Continued*).

On level between locks 30 *and* 31 — 1,108.34 *chains.*

Number.	NAME.	LOCATION OF CENTER LINE. West of Lock 30 Chains.	LOCATION OF CENTER LINE. West of Lock 30 Links.	Character of truss.	MEAN CLEAR SPAN. Feet.	MEAN CLEAR SPAN. Inches.
96	Sturm farm	538	53	Whipple, wooden	71	11
97	Printy farm	612	63	Whipple, wooden	71	0
98	Yates farm	737	00	Whipple, wooden	71	4
99	Downing farm	83	63	Whipple, wooden	71	3
100	M. Yates farm	828	13	Whipple, wooden	71	0
101	A. Yates farm	928	63	Whipple, wooden	71	0
	Downing road	941	15	Wrought iron, rivet and pin, trapezoidal	93	0
	Downing road	1,023	15	Wrought-iron, rivet and pin, trapezoidal	101	6
102	Mitchell farm	1,079	20	Whipple, wooden	70	0
	On level between locks 31 *and* 32 — 505.62 *chains,*					
		West of Lock 31.				
103	Sprakers road	5	9	Whipple, wooden	70	0
104	Ferry street, Sprakers	17	64	Whipple, cast-iron arch	70	2
105	Van Every farm	49	14	Whipple, wooden	71	8
106	Kelley farm	82	78	Whipple, wooden	70	8
107	A. Van Alstine farm	142	44	Whipple, wooden	70	9
108	L. Van Alstyne farm	205	77	Whipple, wooden	71	4
109	Bullock farm	241	87	Whipple, wooden	69	8
110	Canajoharie, street	259	92	Whipple, cast-iron arch	82	1
	Private foot	285	50	Suspension	....	.....
111	Allen farm	314	26	Whipple, wooden	71	0

112	Wagner farm	370	46	Whipple, wooden	70	2
113	Nellis farm	475	54	Whipple, wooden	72	3
	West Shore railroad	....	....	Wrought-iron pin, trapezoidal	....	.....

On level between locks 32 *and* 33 — 408.77 *chains*

West of Lock 32.

114	Morell farm	10	95	Whipple, wooden	71	1
	Lift bridge, Main street	22	62	Wrought-iron, riveted, trapezoidal truss	97	10
115	Foot, Fort Plain	22	95	Suspension	147	0
116	River street, Fort Plain	28	21	Cast-iron pipe arch	71	8
117	Clark farm	59	64	Whipple, wooden	71	11
118	Lipe farm	89	99	Whipple, wooden	70	7
	West Shore railroad	....	....	Wrought-iron, pin, trapezoidal	....	.....
	Private farm	242	65	Whipple, wooden	....	.....
119	Smith farm	337	28	Whipple, wooden	71	10

On level between locks 33 *and* 34 — 205.63 *chains.*

West of Lock 33.

120	Powell farm	23	79	Whipple, wooden	71	7
121	Cox road	66	3	Whipple, combination	82	5
122	Abandoned road	175	83		....	.....
123	Crounse farm	196	10	Whipple, wooden	71	4

On level between locks 34 *and* 35 — 254.23 *chains.*

West of Lock 34.

124	Mindenville road	8	19	Whipple, combination	72	5
125	Brazee farm	45	50	Whipple, combination	85	1
126	Snell farm	71	69	Whipple, combination	71	2
127	East creek landing, road	94	17	Whipple, combination	71	0
128	Smith farm	128	45	Whipple, wooden	71	9
129	Van Alstine farm	174	8	Whipple, wooden	71	9
130	Jones farm	217	51	Whipple, combination	70	7
131	Green farm	241	53	Whipple, combination	70	0

TABLE SHOWING BRIDGES ON THE ERIE CANAL, WITH THEIR LOCATION, ETC.— (*Continued*).

On level between locks 35 *and* 36 — 349.20 *chains.*

Number.	NAME.	LOCATION OF CENTER LINE. West of Lock 35		Character of truss.	MEAN CLEAR SPAN.	
		Chains.	Links.		Feet.	Inches.
132	Fox farm	34	98	Whipple, combination	70	0
133	Kintzinger farm	71	24	Whipple, wooden	72	4
	Private farm	....	....	Whipple, wooden	....	.....
134	Herkimer farm	216	58	Whipple, combination	72	1
135	Fink's basin road	290	56	Whipple, combination	73	3
	On level between locks 38 *and* 39 — 17.35 *chains.*					
		West of Lock 38.				
136	German street, Little Falls	7	88	Cast-iron pipe arch	73	2
	On level between locks 39 *and* 40 — 220.82 *chains.*					
		West of Lock 39.				
137	Moyer road	6	16	Whipple, combination	77	6
	Street, Little Falls	....	....	Wrought-iron riveted lattice	....	.....
138	R. Casler farm	97	46	Whipple, wooden	73	0
139	H. Casler farm	178	39	Whipple, wooden	72	1
	On level between locks 40 *and* 41 — 211.11 *chains.*					
		West of Lock 40.				
	Rankin foot	48	68	Suspension	....	.....
140	Snells farm	73	5	Whipple, combination	72	5
141	Staurings farm	124	83	Whipple, wooden	71	9
142	Steele farm	160	53	Whipple, wooden	70	6
143	Edicks farm	197	36	Whipple, wooden	71	10

On level between locks 41 *and* 42 — 228.99 *chains.*

West of Lock 41.

144	Palmer farm	30	13	Whipple, combination	71	1
	Fisher foot	46	75	Suspension	....	....
145	Lower Herkimer road	109	25	Wrought-iron riveted, arch	70	1
	Cristman foot	130	5	Suspension	...	....
146	Upper Herkimer road	181	16	Whipple cast-iron, arch	78	7
	West Shore railroad	....	....	Wrought-iron pin trapezoidal	....	....
147	Casey road	223	26	Whipple, combination	76	4

On level between locks 43 *and* 44 — 216.16 *chains.*

West of Lock 43.

148	Myers farm	31	24	Whipple, combination	76	3
149	Gas-house road	67	83	Whipple, wooden	71	8
150	East Ilion road	87	32	Cooper, wrought-iron, arch	72	2
151	Ilion street	108	9	Mosely, wrought-iron, arch	72	0
152	Loudon farm	150	61	Whipple, combination	71	6
153	East Frankfort road	186	36	Wrought-iron riveted, trapezoidal	116	5
154	McGowan road	197	46	Whipple, cast-iron arch	74	3

On level between locks 44 *and* 45 — 98.62 *chains.*

West of Lock 44.

155	Richardson and Burton farms	11	46	Whipple, combination	72	0
	Private foot	....	....	Wooden	....	....
156	Palmer's grove road	45	75	Whipple, combination	75	4
157	Ethridge road	77	29	Whipple, wooden	71	10
158	Frankfort road	91	63	Whipple, combination	78	4

On level between locks 45 *and east line of Oneida county* — 537.67 *chains.*

West of Lock 45.

159	Madison street, Frankfort	6	80	Whipple, cast-iron, arch	72	4
160	Davis farm	37	28	Whipple, wooden	72	0

TABLE SHOWING BRIDGES ON THE ERIE CANAL, WITH THEIR LOCATION, ETC.— (*Continued*).

On level between locks 45 and east line of Oneida county — 505.62 *chains* — (Continued).

Number.	NAME.	LOCATION OF CENTER LINE. West of Lock 45 Chains	LOCATION OF CENTER LINE. West of Lock 45 Links.	Character of truss.	MEAN CLEAR SPAN. Feet.	MEAN CLEAR SPAN. Inches.
161	Remington road	74	55	Whipple, combination	74	2
162	Bridenbecker road	96	28	Whipple, wooden	70	6
163	Thomas farm	139	28	Whipple, wooden	71	3
164	Van Buren farm	187	5	Whipple, wooden	69	10
165	Sterling farm	217	83	Whipple, wooden	70	0
166	Robinson farm	296	73	Whipple, wooden	70	7
167	Kensley farm	328	8	Whipple, wooden	71	1
168	Hulson farm	363	90	Whipple, combination	72	0
169	Four-mile grocery farm	387	6	Whipple, wooden	70	4
	Hardiman foot	415	30	Suspension	....	.....
170	Morris road	442	2	Whipple, combination	72	6
	West Shore railroad	....	....	Wrought-iron pin, trapezoidal	....	.....
171	Ferguson road	466	53	Whipple, wooden	72	5
172	Hadd farm	495	68	Whipple, wooden	71	8

BRIDGES OVER SIDE-CUTS AT WEST TROY.

Number.	DESCRIPTION.	Character of truss.	MEAN CLEAR SPAN.	
			Feet.	Inches.
1	Street, over lower side-cut	Cast-iron pipe, trapezoidal	45	4
2	Street, over upper side-cut	Whipple, cast-iron, arch	100	0
3	Tow-path bridge across lower basin	Iron plate, swing	45	0
4	Tow-path bridge across upper basin	Iron plate, swing	60	8
5	Union street, across lower basin	Whipple, wooden	43	0

BRIDGES OVER ROCKY RIFT FEEDER.

Number.	DESCRIPTION.	Character of truss.	Feet.	Inches.
1	Tow-path at entrance	Wooden, stringers	26	7
2	Farm	Whipple, wooden	28	2
3	Farm	Whipple, wooden	29	0
4	Farm	Whipple, wooden	28	1
5	Farm	Whipple, wooden	27	6
6	Farm	Whipple, wooden	29	3
7	Farm	Whipple, wooden	30	2
8	Farm	Wooden stringers	29	10
9	Farm	Whipple, wooden	27	0
10	Farm	Whipple, wooden	29	10
11	Farm	Whipple, wooden	29	7

BRIDGE OVER MOYER CREEK, FRANKFORT.

Number.	DESCRIPTION.	Character of truss.	Feet.	Inches.
1	Moyer creek, road	Wrought-iron, riveted, lattice	34	10

The above bridges may be summarized as follows:

Road or street	92
Farm	99
Road and change	4
Change (only)	1
Tow-path	4
Foot	13
Railroad	10
Abandoned	1
Total	224

Of which only those bearing numbers are owned and maintained by the State of New York.

TABLE SHOWING BRIDGES ON THE CHAMPLAIN CANAL, WITH THEIR LOCATION, SPAN AND STYLE OF SUPERSTRUCTURE.

Between the junction and lock 1.

Number.	NAME.	Location of center line.	Character of truss.	MEAN CLEAR SPAN.	
		Ft. So'th of L. 1		Feet.	Inches.
1	Change	7,266	Wrought-iron, arch	122	10
2	Road	5,621	Wrought-iron, riveted, trapezoidal	98	6
	Road to Green Island	91	Whipple, cast-iron, arch	79	6
		On level between locks 2 and 3.			
		Feet North of Lock 2.			
3	Street, Cohoes	1,384	Wrought-iron, riveted, arch	70	0
4	Ship street Cohoes	1,894	Wrought-iron, riveted, trapezoidal	....	.....
	Cedar street foot, Cohoes	2,406	Whipple, wooden	....	.....
5	Ontario street, Cohoes	3,936	Whipple, cast-iron, arch	66	0
		On level between locks 3 and 4.			
	Over Mohawk river	....	Wrought-iron, riveted, trapezoidal. (Consists of four spans 142 feet and one span 137 feet and six inches	....	.....
		On level between locks 4 and 5.			
		Feet North of Lock 4.			
1	Road and change	753	Whipple, wooden	50	0
2	Farm	2,165	Whipple, combination	57	2
3	Sawmill road, Waterford	4,785	Whipple, wooden	50	5
3½	Tow-path over Waterford side-cut	5,881		....	.....
4	Broad street, Waterford	6,294	Iron	71	6
5	Division street, Waterford	6,669	Whipple, wooden	66	0

TABLE SHOWING BRIDGES ON THE CHAMPLAIN CANAL, ETC. — (*Continued*).

On level between locks 6 and 7.

Number.	NAME.	Location of center line.	Character of truss.	Mean Clear Span.	
		Ft. N'th of L. 6.		Feet.	Inches.
6	Farm	1,501	Whipple, combination	64	0
7	Farm	3,790	Whipple, wooden	61	11
8	Farm	5,762	Whipple, wooden	53	8
9	Farm	6,756	Whipple, wooden	58	0
10	Farm	7,812	Whipple, wooden	55	4
11	Farm	10,126	Whipple, wooden	53	2
12	Farm	11,651	Whipple, wooden	58	0
13	Farm	14,337	Whipple, wooden	52	4
	On level between locks 7 and 8.				
		Feet North of Lock 7.			
14	Farm	2,028	Whipple, wooden	57	0
15	Farm	3,686	Whipple, wooden	58	6
16	Farm	7,015	Whipple, wooden	66	3
	On level between locks 8 and 9.				
		Feet North of Lock 8.			
17	Road	7,656	Whipple, wooden	51	7
18	Road	10,449	Whipple, wooden	59	3
19	Road	11,501	Whipple, wooden	51	3
	Delaware & Hudson Canal Co.'s R. R.	12,310	Wrought-iron, riveted, trapezoidal	....	.....
20	Railroad street Mechanicsville	12,941	Wrought-iron, riveted, trapezoidal lift	....	.....
21	Road	14,371	Whipple, wooden	50	2
22	Road	14,922	Whipple, wooden	54	8
	Pulp mill, side track	16,226	Wrought-iron, riveted, trapezoidal lift	....	.....
23	Farm	16,935	Whipple, wooden	60	0

24	Farm	19,360	Whipple, wooden	58	10
	Fitchburg railroad	20,734	Wrought-iron, pin trapezoidal	....	.....
25		21,602	Whipple, wooden	66	5

On level between locks 9 and 10.

Feet North of Lock 9.

26	Farm	1,652	Whipple, wooden	50	2
27	Road	2,751	Whipple, wooden	54	8
28	Road	4,020	Whipple, wooden	61	5
29	Farm	5,179	Whipple, wooden	57	10
30	Road	5,914	Whipple, wooden	65	10
31	Road	7,408	Whipple, combination	50	7
	Foot	10,011	Whipple, wooden	....	.....
32	Road	10,342	Whipple, wooden	55	9
33	Road	17,015	Whipple, wooden	60	9
34	Farm	18,308	Whipple, wooden	57	1
35	Farm	20,258	Whipple, wooden	61	0
36	Farm	21,423	Whipple, wooden	62	3
37	Road	22,383	Whipple, combination	70	6
38	Road	24,562	Whipple, combination	69	3
39	Farm	26,133	Whipple, wooden	53	6
40	Farm	27,562	Whipple, wooden	58	1
41	Farm	30,865	Whipple, wooden	50	6
42	Farm	32,756	Whipple, wooden	62	9
43	Farm	33,735	Whipple, wooden	61	10
44	Wilbur's basin, road	34,950	Whipple, wooden	57	9
45	Farm	36,834	Whipple, wooden	61	11
46	Farm	38,584	Whipple, wooden	56	0
47	Farm	39,718	Whipple, wooden	60	10
48	Farm	42,735	Whipple, wooden	58	11
49	Farm	43,871	Whipple, wooden	62	5
50	Farm	46,231	Whipple, wooden	64	2

TABLE SHOWING BRIDGES ON THE CHAMPLAIN CANAL, ETC. — (*Continued*).

On level between locks 9 *and* 10 — (Continued).

Number.	NAME.	Location of center line.	Character of truss.	MEAN CLEAR SPAN.	
		Ft. N'th of L. 9.		Feet.	Inches.
51	Salisbury's road	47,738	Whipple, wooden	64	0
52	Farm	51,913	Whipple, wooden	55	5
53	Farm	54,491	Whipple, wooden	48	8
	Costello's foot	56,515	Whipple, wooden	....	.....
54	Farm	57,675	Whipple, wooden	64	2
	Broder's foot	58,622	Whipple, wooden	....	.....
55	Farm	59,701	Whipple, wooden	50	8
56	Farm	60,883	Whipple, wooden	69	2
57	Farm	65,538	Whipple, wooden	54	4
58	Farm	67,009	Whipple, wooden	52	2
59	Farm	70,854	Whipple, wooden	50	0
60	Farm	74,694	Whipple, wooden	65	0
61	Street, Schuylerville	75,732	Whipple, cast-iron, arch	71	5
62	Street, Schuylerville	76,598	Wrought-iron, arch	84	2
63	Farm	81,484	Whipple, wooden	74	11
64	Farm	83,710	Whipple, combination	63	6
65	Change	84,751	Whipple, wooden	65	10

On level between locks 10 *and* 11.

Number.	NAME.	Feet North of Lock 10.	Character of truss.	Feet.	Inches.
	Northumberland bridge over the Hudson river	....	....	....	.....
66	Thompson's mill road	3,293	Whipple, wooden	72	9

On level between locks 11 *and* 12.

		Feet North of Lock 11.			
67	Farm	2,560	Whipple, wooden	65	11
68	Farm	4,898	Whipple, wooden	57	7
69	Farm	6,378	Whipple, wooden	62	9

On level between locks 12 *and* 13.

		Feet North of Lock 12.			
70	Farm	809	Whipple, wooden	59	0
71	Road	1,648	Whipple, wooden	56	7
72	Farm	3,691	Whipple, wooden	55	10
73	Fort Miller, change	4,676	Whipple, wooden	57	4
74	Road	5,479	Whipple, wooden	54	2

On level between locks 13 *and* 14.

		Feet North of Lock 13.			
75	Road and change	912	Wrought-iron, arch	58	0
76	Farm	3,223	Whipple, wooden	50	10
77	Farm	4,969	Whipple, wooden	56	4
78	Farm	6,792	Whipple, wooden	56	0
79	Farm	8,557	Whipple, wooden	55	2
80	Farm	9,597	Whipple, wooden	48	0
81	Road	10,351	Whipple, wooden	56	0
82	Road	12,502	Whipple, wooden	60	0
	Moses Kill, foot	12,811	Whipple, wooden	....	.....

On level between locks 14 *and* 15.

		Feet North of Lock 14.			
83	Road	957	Whipple, combination	70	0
84	Road	2,364	Whipple, wooden	62	3
85	Farm	5,457	Whipple, wooden	59	6
86	Road	6,454	Whipple, wooden	56	1

TABLE SHOWING BRIDGES ON THE CHAMPLAIN CANAL, ETC.—(*Continued*).

On level between locks 14 *and* 15—(Continued).

Number.	NAME.	Location of center line.	Character of truss.	Mean Clear Span.	
		Ft. N'th of L. 14		Feet.	Inches.
	Satterlee's foot	7,204	Whipple, wooden	....	.....
87	Farm	8,178	Whipple, wooden	61	9
88	Road	11,042	Whipple, combination	68	0
89	Road	11,996	Whipple, wooden	62	0
90	Road	12,494	Whipple, wooden	55	3
91	Farm	13,715	Whipple, wooden	58	1
92	Farm	15,179	Whipple, wooden	57	0
93	Farm	16,095	Whipple, wooden	50	0
94	Farm	17,503	Whipple, wooden	56	2
95	Farm	18,784	Whipple, wooden	55	2
96	Road	24,122	Whipple, combination	80	4
97	Fort Edward road and change	25,917	Wrought-iron, pin, arch	78	7
98	Notre Dame street, Fort Edward	27,370	Wrought-iron, pin, arch	79	7
	D. & H. R. R. main line	27,903	Wrought-iron, riveted, trapezoidal	....	.....
99	East street, Fort Edward	28,631	Whipple, cast-iron, arch	59	5
	D. & H. R. R., G. F. branch	29,130	Wrought-iron plate girder	....	.....
	On level between locks 15 and 16.				
		Feet North of Lock 15.			
100	Road	1,417	Whipple, wooden	76	8
	Foot	2,427	Suspension	80	0
101	Change	10,655	Wrought-iron, arch	79	8
102	Farm	12,935	Whipple, wooden	50	9
103	Dunham's road	16,657	Whipple, combination	57	4

104	Road	33,153	Whipple, wooden	52	1
105	Farm	34,281	Whipple, wooden	52	0
106	Smith's Basin road	40,867	Whipple, combination	57	6
107	Road	43,113	Whipple, wooden	56	0
108	Farm	45,870	Whipple, wooden	63	0
109	Farm	47,271	Whipple, wooden	57	10
110	Farm	48,308	Whipple, wooden	57	3
111	Road	50,995	Whipple, wooden	52	4
112	Road	53,179	Whipple, wooden	52	4
113	Farm	55,810	Whipple, wooden	56	2
114	Farm	58,146	Whipple, wooden	56	3
115	Farm	59,048	Whipple, wooden	52	4
	Foot	61,495	....	78	0

On level between locks 17 *and* 18.

Feet North of Lock 17.

116	Road, Fort Ann	173	Wrought-iron, riveted, trapezoidal	78	6

On level between locks 18 *and* 19.

Feet North of Lock 18.

	Delaware and Hudson railroad	322	Wrought-iron, riveted, trapezoidal	....	.....
117	Change	666	Whipple, combination	66	4
118	Farm	1,558	Whipple, wooden	61	5
119	Farm	8,295	Whipple, wooden	58	6
	Dewey's road (private)	13,405	Wrought-iron, pin, trapezoidal	....	.....

On level between locks 19 *and* 20.

Feet North of Lock 19.

120	Tow-path	1,712	....	34	0
121	Road	4,635	Wrought-iron, arch	72	10
	Private road	9,356	Town, wooden, covered	69	0
122	Farm	13,825	Whipple, wooden	72	0

TABLE SHOWING BRIDGES ON CHAMPLAIN CANAL, ETC. — (*Continued*).

On level between locks 20 and 21.

Number.	NAME.	Location of center line.	Character of truss.	Mean Clear Span.	
		Ft. N'th of L. 20		Feet.	Inches.
123	Change	56	Whipple, wooden	57	2
124	Road	765	Whipple, wooden	62	2
125	Farm	1,953	Whipple, wooden	64	2
	Delaware and Hudson railroad	2,305	Wrought-iron, riveted, trapezoidal	132	0
126	Farm	3,582	Whipple, wooden	56	3
127	Farm	4,750	Whipple, wooden	63	3
128	Road	7,790	Wrought-iron, rivet and pin, arch	67	7
129	Farm	10,463	Whipple, wooden	67	6
130	Farm	11,171	Whipple, wooden	66	9
131	Abandoned abutment	14,077	....	....	.....
132	Farm	15,215	Whipple, wooden	62	7
133	Farm	17,582	Whipple, wooden	57	10
134	Abandoned bents (private)	18,615	....	....	.....
135	Farm	22,035	Whipple, wooden	62	11
	Delaware and Hudson railroad	23,118	Wrought-iron, riveted, trapezoidal	96	6
136	Abandoned abutment	23,885	....	....	.....
	Del. & Hud. R. R., Rutland branch	25,753	Wrought-iron, riveted, trapezoidal	90	9
137	Road	26,295	Whipple, combination	68	6
	Horse bridge	27,700	Whipple, combination	102	4
138	Street, Whitehall	28,522	Wrought-iron, pin, arch	82	2
139	Foot, Whitehall	28,912	Wrought-iron, riveted, trapezoidal	57	9
		Over lock 23.			
		Feet South of L. H. Q.			
140	Street, Whitehall	81	Wrought-iron, pin, arch	93	0

LIST OF BENCH MARKS ON EASTERN DIVISION, NEW YORK STATE CANALS.

[T. W.=Mean low water in Hudson river at Albany, as established by the United States Engineering Corps in 1873. Canal bottom is taken as elevation of lower miter-sill of upper lock on the several levels.]

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
1	On shelf at lower end of pier between locks at lock No. 1, marked ⊕ with chisel	....	+ 9.486
2	Lower miter-sill, lock No. 1	+0.000	—7.443
3	The coping of lock No. 1	....	....
4	At station 53½, on tow-path abutment, Ferry street bridge on the north stone, lower course, marked ⊕ with chisel	" 9.524	+17.240
5	At station 82¾, on tow-path tower of suspension foot bridge, on projection of south cross-sill, marked ⊕ with knife (destroyed)	....	....
6	Lower miter-sill, lock No. 2 (at heel of S. W. gate, W. lock)	" 0.000	" 7.716
7	At station O, on coping of lock No. 2, between ends of anchor of S. W. gate of W. lock, marked ⊕-BM with chisel	+18.000 lower level " 8.505 upper level	" 25.716
8	At station 39, on N. end tow-path parapet of culvert, marked ⊕-BM with chisel	+ 7.288	" 24.494
9	At station 97½, on N. end tow-path parapet of culvert, marked ⊕-BM with chisel	" 7.980	" 25.191
10	At station 156, on S. E. corner of coping on retaining wall of bridge approach, marked ⊕ with chisel	" 10.410	" 27.621
11	At station 166, on N. E. corner tow-path parapet of culvert, marked ⊕ with chisel	" 8.543	" 25.754
12	At station 189 on coping of retaining wall at S. end of tow-path parapet of culvert, marked ⊕-BM with chisel	" 8.066	" 25.277
13	At station 217, on N. end of retaining wall to bridge approach, N. E. corner of coping, marked ⊕-BM with chisel	" 10.406	" 27.617

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
14	At station 243¾, N. E. corner N. wing of tow-path abutment on coping marked ⊕, and on face of coping BM, with chisel.	+14.574	+ 31.785
15	At station 269, on coping of lock on "lower side cut," at anchor of N. W. gate, marked ⊕-BM with chisel.	" 8.584	" 25.795
16	At station 290, on tow-path abutment of arsenal bridge at N. angle of main wall, top of lower course, marked ⊕ and (above) BM with chisel.	"11.566	" 28.777
17	At station 320, on tow-path abutment of Ferry street bridge, S. E. corner of lower step of wing, marked ⊕ with chisel and (on face of stone) BM.	"11.563	" 28.774
18	At station 365, on coping of N. wall, north lock of upper side-cut, N. W. corner of W. stone, marked ⊕-BM with chisel.	" 9.257	" 26.468
19	At station 398½, on N. E. corner tow-path parapet of culvert, marked ⊕-BM with chisel	" 8.480	" 25.691
20	Lower miter-sill of lock No. 3, at heel of S. W. gate of W. lock	" 0.000	" 17.211
21	On coping of lock No. 3, between ends of anchor S. W. gate of W. lock, marked ⊕-BM with chisel.	+20.260 lower level " 9.091 upper level	" 37.471
22	Lower miter-sill of lock No. 4 (at heel of S. W. gate, W. lock)	+0.000	" 28.380
23	On coping of lock No. 4, between ends of anchor S. W. gate, W. lock, marked ⊕-BM with chisel	"20.220 lower level " 8.840 upper level	" 48.600
24	Lower miter-sill, lock No. 5, at heel of S. E. gate, E. lock.	+0.000	" 39.760
25	On coping of lock No. 5, between ends of anchor S. E. gate, E. lock, marked ⊕-BM with chisel	"19.630 lower level " 9.033 upper level	" 59.390
26	Lower miter-sill, lock No. 6, at heel of S. W. gate, W. lock	+0.000	" 50.357

27	On coping of lock No. 6, between ends of anchor, S. W. gate, W. lock, marked ⊕-BM with chisel	"19.000 lower level " 8.927 upper level	" 69.357
28	Lower miter-sill, lock No. 7, at heel of S. E. gate, E. lock	+0.000	" 60.430
29	On coping, lock No. 7, between ends of anchor, S. E. gate, E. lock, marked ⊕-BM with chisel	"18.580 lower level " 8.649 upper level	" 79.010
30	Lower miter-sill, lock No. 8, at heel of S. W. gate, W. lock	+0.000	" 70.361
31	On coping, lock No. 8, between ends of anchor, S. W. gate, W. lock, marked ⊕-BM with chisel	"18.885 lower level " 8.340 upper level	" 89.246
32	Lower miter-sill, lock No. 9, at heel of S. E. gate, E. lock	+0.000	" 80.906
33	On coping, lock No. 9, between ends of anchor, S. E. gate, E. lock, marked ⊕-BM with chisel	"18.500 lower level " 9.092 upper level	" 99.406
34	Lower miter-sill, lock No. 10, at heel of S. W. gate, W. lock	+0.000	" 90.314
35	On coping, lock No. 10, between ends of anchor, S. W. gate, lock W. marked ⊕-BM with chisel	"19.000 lower level " 8.638 upper level	" 109.314
36	Lower miter-sill, lock No. 11, at heel of S. W. gate, W. lock	+0.000	" 100.676
37	On coping, lock No. 11, between ends of anchor, S. W. gate, W. lock, marked ⊕-BM with chisel	"18.650 lower level " 9.029 upper level	" 119.326
38	Lower miter-sill, lock No. 12, at heel of S. W. gate, W. lock	+0.000	" 110.297
39	On coping, lock No. 12, between ends of anchor, S. W. gate, W. lock, marked ⊕-BM with chisel	"19.090 lower level " 9.194 upper level	" 129.387
40	Lower miter-sill, lock No. 13, at heel of S. E. gate, E. lock	+0.000	" 120.193
41	On coping, lock No. 13, between ends of anchor, S. E. gate, E. lock, marked ⊕-BM with chisel	"19.100 lower level " 8.745 upper level	" 139.293
42	Lower miter-sill, lock No. 14, at heel of S. E. gate, E. lock	+0.000	" 130.548
43	On coping, lock No. 14, between ends of anchor, S. E. gate, E. lock, marked ⊕-BM with chisel	"18.700 lower level " 8.668 upper level	" 149.248
44	Lower miter-sill, lock No. 15, at heel of S. E. gate, E. lock	+0.000	" 140.580
45	On coping, lock No. 15, between ends of anchor, S. E. gate, E. lock, marked ⊕-BM with chisel	"18.800 lower level " 8.967 upper level	" 159.380

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
46	Lower miter-sill, lock 16, at heel of S. E. gate, E. lock	+0.000	+ 150.413
47	On coping, lock No. 16, between ends of anchor, S. E. gate, E. lock, marked ⊕-BM with chisel	+18.920 lower level " 8.875 upper level	" 169.333
48	Lower miter-sill, lock No. 17, at heel of S. W. gate, W. lock	0.000	" 160.458
49	On coping, lock No. 17, between ends of anchor, S. W. gate, W. lock, marked ⊕-BM with chisel	"19.020 lower level " 8.733 upper level	" 179.478
50	Lower miter-sill, lock No. 18, at heel of S. W. gate, W. lock	0.000	" 170.745
51	On coping, lock No. 18, between ends of anchor, S. W. gate, W. lock, marked ⊕-BM with chisel	"19.040 lower level " 8.791 upper level	" 189.785
52	At station $18\frac{1}{4}$, on coping of south abutment of waste-weir on tow-path, marked ⊕-BM with chisel	+ 9.035	" 190.029
53	At station $57\frac{1}{2}$, on N. end berme abutment (wing) of bridge, marked ⊕-BM with chisel	" 10.156	" 191.150
54	At station $128\frac{1}{2}$, S. E. corner coping, N. wing berme abutment of farm bridge, marked ⊕-BM with chisel	" 15.526	" 196.520
55	At station $128\frac{1}{2}$, on N. end tow-path abutment of farm bridge, on projection of fifth stone from top at N. end of wing, marked ⊕ and on stone above BM with chisel	" 12.024	" 193.018
57	At station $168\frac{3}{4}$, on top of coping of S. wing, at end tow-path abutment of farm bridge, marked ⊕-BM with chisel	" 11.143	" 192.137
58	At station $169\frac{1}{4}$, on top of coping of N. wing, at end berme abutment of farm bridge, marked ⊕-BM with chisel	" 11.461	" 192.455
59	At station $220\frac{1}{4}$, on top of coping, S. W. corner S. E. wing of aqueduct, marked ⊕-BM with chisel	" 13.308	" 194.302

60	At station 238, on top of coping N. W. corner N. W. wing of aqueduct, marked ⊕-BM with chisel	“13.189	“ 194.183
61	At station 340, on projection on face of first stone under coping, east wing tow-path abutment, marked ⊕-BM with chisel	“11.552	“ 192.546
62	At station 340, at center of tow-path abutment, on face of sixth course under coping, marked BM-⊕ with chisel	“10.176	“ 191.170
64	At station $432\frac{1}{2}$, on projection on sixth course below coping, near center tow-path abutment, marked BM-⊕ with chisel	“ 9.949	“ 190.943
65	At station 461, on rock at rear of tow-path, marked ⊕-BM	“11.158	“ 192.152
66	At station $512\frac{1}{4}$, on projection on sixth course below coping, near W. angle face of tow-path abutment (Clute’s) road bridge, marked BM-⊕ with chisel	“11.079	“ 192.073
67	At station $521\frac{1}{2}$, on face of E. wing tow-path abutment of first bridge W. of Clute’s dry dock, end stone second course below coping, marked ⊕-BM with chisel	“11.294	“ 192.288
68	At station 543, on face of tow-path abutment, second bridge W. of Clute’s dry-dock, sixth course below coping, near E. angle, marked BM-⊕ with chisel	“10.900	“ 191.894
69	At station 568, on face tow-path abutment, third bridge W. of Clute’s dry-dock, fifth course below coping near W. angle, marked BM-⊕ with chisel	“10.959	“ 191.953
70	At station $598\frac{1}{2}$, on face tow-path abutment, road bridge at Whitehead’s dock, on sixth course below coping near center of abutment, marked BM-⊕ with chisel	“ 9.529	“ 190.523
71	At station $633\frac{3}{4}$, on face tow-path abutment of farm bridge, near center on projection of footing course sixth below coping, marked BM-⊕,	“ 8.163	“ 189.157
72	At station $658\frac{1}{2}$, on face tow-path abutment of second bridge E. of lock 19, on projection on fifth course below coping near E. angle, marked ⊕-BM with chisel	9.710	“ 190.704

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
73	At station 693¼, on top of E. corner, first stone under coping, E. wing of tow-path abutment of first bridge E. of lock 19, marked ⊕ (on top) BM (on face) with chisel	+11.753	+ 192.748
74	Lower miter-sill, lock No. 19, at heel of N. E. gate of S. lock (pier wall)	" 0.000	" 180.994
75	On coping lock No. 19, near ends of anchor N. E. gate, S. lock (pier wall), marked ⊕–BM with chisel	+17.22 lower level " 8.779 upper level	" 198.214
76	At station 70, on N. corner of coping, at end of W. wing of tow-path abutment, road bridge at Vischer's Ferry, marked (on top) ⊕ and (on face) ⊕–BM with chisel	+12.119	" 201.554
77	At station 140, on rock, cut on rock at rear of tow-path, marked BM⊕ with chisel	"10.713	" 200.148
79	Lower miter-sill, lock No. 20, at heel of N. E. gate, N. lock	" 0.000	" 189.435
80	On coping, lock No. 20, at ends of anchor, N. E. gate, N. lock, marked ⊕–BM with chisel	+18.660 lower level " 8.242 upper level	" 208.095
81	At station 108½, above lock No. 20, on top of coping at E. end of wing berme abutment, road bridge at Fonda's basin, marked ⊕ and (on face) BM with chisel	+12.710	" 212.563
82	Lower miter-sill, lock No. 21, at heel of S. E. gate, S. lock	" 0.000	" 199.853
83	On coping, lock No. 21, at ends of anchor, S. E. gate, S. lock, marked ⊕–BM with chisel	+19.720 lower level " 8.594 upper level	" 219.573
84	Lower miter-sill, lock No. 22, at heel of N. E. gate, N. lock	+0.000	" 210.979
85	On coping, lock No. 22, near ends of anchor, N. E. gate N. lock, marked ⊕–BM with chisel	" 20.180 lower level " 8.571 upper level	" 231.159

86	At station 6½, on N. E. corner of coping on end of tow-path wing, N. end of upper Mohawk aqueduct, marked ⊕, and on face of stone BM with chisel	" 9.418	" 232.006
87	At station 16, on top dowel in coping, near end of parapet, tow-path wing, south end of aqueduct ⊕, and on stone near it ⊕-BM, with chisel	" 13.089	" 235.677
88	At station 24¼, on north wing of berme abutment of first road bridge west of aqueduct, top of coping marked ⊕, and on face of stone BM with chisel	" 12.928	" 235.516
89	At station 143, on face of tow-path abutment, Vedder's bridge, projection on lower course near W. angle, marked ⊕, and on stone above BM with chisel	" 8.556	" 231.144
90	At station 161¾, on face of tow-path abutment of farm bridge near center projection of sixth course under coping, marked BM-⊕ with chisel	" 10.673	" 233.261
91	Station 210, on face of tow-path abutment of R. R. bridge, on stone near W. end, about 2½ in. above joint, marked BM-⊕ with chisel	" 11.031	" 233.619
92	Station 230½, on top of coping on end of W. wing berme abutment road bridge, marked ⊕-BM (on top of coping) with chisel	" 10.208	" 232.796
93	Station 264, on top of coping on end of E. wing of tow-path abutment of road bridge, marked ⊕, and on face of stone BM, with chisel	" 11.783	" 234.371
94	Station 284, on top of coping on end of E. wing of berme abutment of Front street bridge, marked ⊕, and on face of stone BM, with chisel,	" 10.189	" 232.777
95	Station 311, on S. W. corner of coping of retaining wall E. of street bridge, marked ⊕, and on face of stone BM, with chisel	" 13.695	" 236.283
96	Station 337, on third step from bottom at E. end of tow-path abutment, State street bridge, marked ⊕, and on end of step BM, with chisel,	" 12.014	" 234.602
97	Station 368½, on top of coping, S. W. corner of parapet of waste-weir, marked ⊕, and (on face) BM, with chisel	" 11.630	" 234.218

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
98	Station $504\frac{1}{2}$, near center of face of tow-path abutment of bridge at Navanier's Bay, on projection of sixth course below coping, marked ⊕, and on stone above BM, with chisel	+ 9.324	+ 231.912
99	Lower miter-sill of lock No. 23, at heel of N. E. gate, N. lock	" 0.000	" 222.588
100	On top of coping, lock No. 23, at end of anchor N. E. gate, N. lock, marked ⊕–BM with chisel	+16.900 lower level " 8.582 upper level	" 239.488
101	Station 9, on face of tow-path abutment of farm bridge, near W. angle on projection of sixth course below coping, marked ⊕, and on stone above BM, with chisel	+ 9.115	" 240.021
102	Lower miter-sill of lock No. 24, at heel of N. E. gate, N. lock	" 0.000	" 230.906
103	On coping of lock No. 24, at end of anchor, N. E. gate, N. lock, marked ⊕–BM with chisel	"16.860 lower level " 8.669 upper level	" 247.766
104	Station $49\frac{3}{4}$, on face of tow-path abutment of road bridge on projection on course below coping, marked ⊕, and on stone above BM, with chisel	+ 11.537	" 250.634
105	Station $99\frac{1}{4}$, on face of tow-path abutment of farm bridge, on projection on sixth course below coping, near E. angle, marked BM– ⊕(on the stone) with chisel	" 10.020	" 249.117
106	Station 113+88, on E. end of Flat Stone creek aqueduct, tow-path side abutment, 6 in. east of junction of wing and straight wall at foot of parapet, marked ⊕, and (on face of coping of parapet above it) BM, with chisel	" 9.203	" 248.300
107	Station $181\frac{1}{2}$, near center of face of tow-path abutment of road bridge, on projection of sixth course below coping, marked BM–⊕ with chisel	" 11.372	" 250.469

108	Station 218, near W. angle face of tow-path abutment of farm bridge, on projection of seventh course below coping, marked ⊕, and on stone above BM, with chisel..................................	" 10.597	" 249.694
109	Station 294½, at center of face of tow-path abutment, first bridge below lock No. 25, on projection of footing course (seventh below coping), marked ⊕, and on stone above BM, with chisel.................	" 8.873	" 247.972
110	Lower miter-sill of lock No. 25, at heel of N. E. gate, N. lock, marked ⊕.	" 0.000	" 239.097
111	On coping of lock 25, at end of anchor, N. E. gate, N. lock, marked ⊕-BM with chisel..................................	"16.655 lower level " 8.949 upper level	" 255.762
112	Station 40½, on corner of coping, end of W. wing tow-path abutment of farm bridge, marked ⊕ (on top) and BM (on face) with chisel....	+ 11.531	" 258.344
113	Station 74, on face tow-path abutment farm bridge (near W. angle), on projection of fourth course below coping, marked ⊕, and on stone above BM with chisel................................	"12.321	" 259.134
114	Station 118, on coping, end of W. wing berme abutment of road bridge marked ⊕-BM with chisel	"11.530	" 258.343
115	Station 171, on coping of parapet Sansai Kill aqueduct, at E. angle (junction of wing with straight wall), marked ⊕ BM with chisel..	"12.650	" 259.463
116	Station 253+80, on small granite boulder, rear of tow-path (is about fifty feet east of line of stone fence between orchard and corn-field on hill across canal), marked ⊕-BM with chisel...............	" 8.386	" 255.199
117	Station 285½, on flat, white rock at N. angle of tow-path, opposite the middle of the bay, below lower end of rock bluff on berme, marked ⊕ BM with chisel..	" 8.747	" 255.560
118	Station 347, on flat sand stone at rear tow-path and at west end of first course below Swarts' bridge, marked ⊕ BM with chisel.....	" 8.223	" 255.036
119	Station 360¾, on parapet of culvert (berme side) of N. W. corner of coping, marked ⊕ BM with chisel................................	" 1.240	" 248.053
120	Station 398½, on top of stone under coping, on E. wing of tow-path abutment of Klein's bridge, marked ⊕ (on face) and BM with chisel.	"12.485	" 259.298

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
121	Station 460, on coping E. wing tow-path abutment of farm bridge, marked ⊕, and on face BM, with chisel	+12.492	+259.305
122	Lower miter-sill, lock No. 26, at heel of N. E. gate, N. lock, marked ⊕BM,	" 0.000	" 246.813
123	On coping, lock No. 26, at end of anchor, N. E. gate, N. lock, marked ⊕-BM with chisel	+16.870 lower level " 8.505 upper level	" 263.683
124	Lower miter-sill, lock No. 27, at heel of N. E. gate, N. lock	+0.000	" 255.178
125	On coping of lock No. 27, at end of anchor, N. E. gate, N. lock, marked ⊕-BM with chisel	" 16.430 lower level " 8.544 upper level	" 271.608
126	Station 61½, on retaining wall over berme end of culvert, 5 in. west of center line, marked ⊕ with chisel	+ 3.379	" 266.543
127	Station 96½, on tow-path end of culvert at top of sloping coping, at E. corner of second stone from E. side, marked ⊕-BM with chisel	" 2.109	" 265.273
128	Station 163¾, on coping of waste-weir (near N. W. corner of top of E. wall, marked ⊕-BM with chisel	" 8.723	" 271.887
129	Station 203½, on top of lower step at W. end tow-path abutment of street bridge (east bridge at Port Jackson), marked ⊕-BM with chisel	" 16.281	" 279.445
130	Station 225¼, on top of coping at center pier of Port Jackson creek culvert (T. P. side), marked ⊕, and (on slope) BM, with chisel	" 0.344	" 263.508
131	Lower miter-sill, lock No. 28, at heel of S. E. gate, S. lock, marked ⊕BM,	" 0.000	" 263.164
132	On top of coping, lock No. 28, at end of anchor, S. E. gate, S. lock, marked ⊕-BM with chisel	+16.870 lower level " 9.147 upper level	" 280.034
133	Station 85¾, at E. end of tow-path abutment, farm bridge, on top of 3d stone above ground, marked ⊕, and (on face) BM, with chisel	+12.260	" 283.147
134	Station 138, on center face of tow-path abutment, farm bridge, on projection of 6th stone below coping, marked ⊕-BM with chisel	" 11.717	" 282.604

135	Lower miter-sill, lock No. 29, at heel of N. E. gate, N. lock	" 0.000	" 270.887
136	On coping lock No. 29, at end of anchor, N. E. gate, N. lock, marked ⊕-BM with chisel	+16.520 lower level " 9.121 upper level	" 287.407
137	Station 30 on face of tow-path abutment of farm bridge, on projection of 4th stone below coping, near E. angle, marked ⊕-BM with chisel.	+12.491	" 290.777
138	Lower miter-sill, lock No. 30, at heel of N. E. gate, N. lock	" 0.000	" 278.286
139	On coping, lock No. 30, at end of anchor, N. E. gate, N. lock, marked	"19.370 lower level " 9.157 upper level	" 297.656
140	Station 18¾, at foot of parapet, at end of W. wing, tow-path side of Schoharie creek aqueduct, marked ⊕, and on parapet above BM, with chisel	+ 10.205	" 298.704
142	Station 123½, top of lower step, W. wing, berme abutment of farm bridge, marked ⊕, and BM (on end of stone) with chisel	" 13.411	" 301.910
143	Station 152¼, on face of tow-path abutment, near E. angle on projection of 5th course below coping, marked ⊕, and (on stone above) BM, with chisel	" 11.899	" 300.398
144	Station 181¼, on face of tow-path abutment of farm bridge on projection of 6th course below coping, near W. angle, marked ⊕, and (on stone above) BM, with chisel	" 11.595	" 300.094
145	Station 253½, on face of tow-path abutment of farm bridge, near E. angle, on projection of 5th course below coping, marked ⊕, and (on stone above) BM, with chisel	" 11.474	" 300.883
146	Station 281, on face of tow-path abutment of covered road bridge, near west angle of projection of 4th stone below coping, marked ⊕, and (on stone above) BM, with chisel	" 12.070	" 300.569
147	Station 306¼, top of lower step of W. wing, berme abutment of farm bridge, marked ⊕-BM with chisel	" 13.485	" 301.984
148	Station 345¼, on top of lower step, E. wing, berme abutment of farm bridge, marked ⊕ with chisel	" 11.928	" 300.427

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
149	Station 394, on top of lower step, W. wing of berme abutment, marked ⊕ with chisel	+11.331	+299.830
150	Station 482½, on top of coping at end of E. wing of tow-path abutment of farm bridge, marked ⊕, and (on face of stone) BM, with chisel	" 12.717	" 301.216
151	Station 539, on face of tow-path abutment of farm bridge, near E. angle, on projection of 4th course below coping, marked ⊕-BM with chisel	" 11.359	" 299.849
152	Station 613, on face of top stone, end of W. wing, tow-path abutment of farm bridge, on projection of stone, marked ⊕-BM with chisel	" 11.896	" 300.395
153	Station 664¾, on top of coping at end of E. wing of Tokkon creek aqueduct, tow-path side, marked ⊕-BM with chisel	" 8.024	" 296.523
154	Station 737, on face of tow-path abutment of farm bridge, near E. angle, on projection of 4th stone below coping, marked ⊕-BM with chisel	" 10.856	" 299.355
155	Station 813½, on top of second stone below coping, at end of E. wing of berme abutment of Farm bridge at Yatesville, marked ⊕, and (on stone above) BM, with chisel	" 10.594	" 299.093
156	Station 846¼, on top of coping, N. E. corner N. E. wing of Leonardson's creek aqueduct, marked ⊕-BM with chisel	" 8.122	" 296.621
157	Station 935, on top of coping of E. abutment of aqueduct, N. W. cor. (tow-path side) of main wall, marked ⊕-BM with chisel	" 7.979	" 296.478
158	Station 1,079½, on top of lower step, W. wing berme abutment of farm bridge, marked ⊕-BM with chisel	" 12.337	" 300.836
159	Lower miter-sill of lock 31, at heel of N. E. gate, S. lock on (pier side),	" 0.000	" 288.499

160	On coping, lock 31, at end of anchor, N. E. gate S. lock (pier wall), marked ⊕-BM with chisel	"14.760 lower level " 8.893 upper level	" 303.259
161	Station 17½, on face of tow-path abutment, Ferry street bridge, on projection of fifth course below coping (near center, old bench), marked ⊕-BM with chisel	+10.392	" 304.758
162	Station 49¼, on face of tow-path abutment of farm bridge, projection on fifth course below coping, near W. angle, marked ⊕-BM with chisel	" 11.325	" 305.691
163	Station 82¾, on face of tow-path abutment of farm bridge, projection of sixth course below coping, near center, marked BM-⊕ with chisel	" 9.990	" 304.356
164	Station 142⅓, on face of tow-path abutment of farm bridge, on projection of seventh course below coping, near W. angle, marked ⊕-BM with chisel	" 8.824	" 303.190
165	Station 205¾, on face tow-path abutment of farm bridge, on projection of fourth course under coping (near center), marked BM-⊕	" 9.873	" 304.239
166	Station 252, on top of coping of parapet at N. E. wing of Plattkill aqueduct (N. E. corner of end stone), marked ⊕ and on face BM with chisel	" 13.194	" 307.560
167	Station 314, on top of coping at end of E. wing tow-path abutment of farm bridge, marked ⊕ and (on face) BM with chisel	" 12.412	" 306.778
168	Station 370½, on rear upper corner of first stone under coping at end of W. wing, berme abutment of farm bridge, marked ⊕-BM with chisel,	" 11.150	" 305.516
169	Station 475¼, on tow-path abutment of farm bridge, near center of face of E. wing, projection on second stone above ground, marked BM-⊕ with chisel	" 10.689	" 305.055
170	Lower miter-sill, lock No. 32 (at heel of N. E. gate, N. lock)	" 0.000	" 294.366
171	On coping, lock 32, at end of anchor, N. E. gate, N. lock, marked ⊕-BM with chisel	"17.110 lower level " 8.984 upper level	" 311.476

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
172	Station 27¾, on front corner, third step from bottom, on E. wing tow-path abutment iron street bridge, marked ⊕ and (on end of stone) BM with chisel	+ 11.905	+ 314.397
173	Station 60, on top coping at end of W. wing tow-path abutment, farm bridge, marked ⊕, and on face BM with chisel	" 11.145	" 313.637
174	Station 90, on face of tow-path abutment of farm bridge (near center) projection of sixth course below coping, marked ⊕ and (on stone above) BM with chisel	" 9.420	" 311.912
175	Station 122, on coping of parapet, tow-path end of culvert at center, marked BM-⊕ with chisel	" 4.461	" 306.953
176	Station 314¾, on corner of coping, E. wing wall of culvert, marked ⊕-BM with chisel	" 6.712	" 309.204
177	Station 337, on face of tow-path abutment of farm bridge, at W. angle projection on sixth course below coping, marked BM-⊕ with chisel	" 10.353	" 312.845
178	Lower miter-sill, lock No. 33 (at heel of N. E. gate, N. lock)	" 0.000	" 302.492
179	On coping, lock No. 33, at end of anchor of N. E. gate, N. lock, marked ⊕-BM with chisel	+14.770 lower level " 9.066 upper level	" 317.262
180	Station 29¼, on coping of tow-path parapet of culvert (near center) marked ⊕-BM with chisel	+ 2.414	" 310.610
181	Station 65¾, on lower step, E. wing tow-path abutment of road bridge, marked ⊕, and on face BM, with chisel	" 13.439	" 321.635
182	Station 175¾, on face tow-path abutment of farm bridge near E. angle projection on fifth course below coping, marked ⊕-BM with chisel,	" 11.421	" 319.617
183	Lower miter-sill, lock No. 34, at heel of N. E. gate, N. lock	" 0.000	" 308.196

184	On coping, lock No. 34, at end of anchor N. E. gate, N. lock, marked ⊕-BM with chisel	“17.080 lower level “ 8.597 upper level	“ 325.276
185	Station 45½, on face of tow-path abutment of farm bridge near W. angle projection of seventh course below coping, marked BM—⊕ with chisel	+ 8.774	“ 325.453
186	Station 94, on face of tow-path abutment of road bridge (E. creek landing) near center projection of seventh course below coping, marked ⊕, and (on stone above) BM with chisel	“ 10.912	“ 327.591
187	Station 174¼, on face of tow-path abutment of farm bridge, near W. angle projection of seventh course below coping, marked ⊕, and (on stone above) BM with chisel	“ 9.829	“ 325.508
188	Station 217½, on face of tow-path abutment of farm bridge, near center projection of seventh course below coping, marked ⊕-BM with chisel	“ 9.619	“ 326.298
189	Lower miter-sill, lock No. 35, at heel of N. E. gate, N. lock	“ 0.000	“ 316.679
190	On coping, lock No. 35, at end of anchor N. E. gate, N. lock, marked ⊕-BM with chisel	“ 16.850 lower level “ 9.065 upper level	“ 333.529
191	Station 35, at center of face, W. wing tow-path abutment, third course above ground, marked ⊕-BM with chisel	+ 11.233	“ 335.697
192	Station 71, on top of coping E. wing berme abutment of farm bridge, marked ⊕-BM with chisel	“ 13.826	“ 338290
193	Station 216¼, on top of coping E. wing tow-path abutment of farm bridge, marked ⊕, and (on face) BM with chisel	“ 12.053	“ 336.517
195	Lower miter-sill of lock No. 36, at heel of N. E. gate, N. lock	“ 0.000	“ 324.464
196	On top of coping, lock No. 36 (at E. end of hollow quoin stone), N. E. gate, N. lock, marked ⊕-BM with chisel	“ 18.780 lower level “ 8.761 upper level	“ 343.244
197	Lower miter-sill of lock No. 37 (at heel of N. E. gate, N. lock)	+0.000	“ 334.483
198	On coping, lock No. 37, at end of anchor N. E. gate, N. lock, marked ⊕-BM	“ 18.790 lower level “ 8.892 upper level	“ 353.273

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
199	Lower miter-sill, lock No. 38, at heel of N. E. gate, N. lock.........	+0.000	+ 344.381
200	On coping, lock No. 38, at end of anchor N. E. gate, N. lock, marked,	+18.520 lower level " 9.787 upper level	" 362.901
201	Lower miter-sill, lock No. 39, at heel N. E. gate, N. lock	+0.000	" 353.114
202	On coping, lock No. 39, at end of anchor N. E. gate, N. lock, marked,	" 19.830 lower level " 9.306 upper level	" 372.944
203	Destroyed.		
204	Station 97¼, on top of coping, end of E. wing tow-path abutment of farm bridge, marked ⊕, and on face BM with chisel.............	+14.010	" 377.648
205	Station 178¾, on top of coping, at end of W. wing berme abutment of farm bridge, marked ⊕-BM with chisel	" 14.463	" 378.101
206	Lower miter-sill, lock No. 40, at heel of N. E. gate, N. lock.........	" 0.000	" 363.638
207	On top of coping, lock No. 40, at end of anchor N. E. gate, N. lock, marked	" 17.080 lower level " 8.556 upper level	" 380.718
208	Station 73¼, on top of stone under coping at end of W. wing tow-path abutment of farm bridge, marked ⊕, and (at end of stone) BM with chisel..	+12.357	" 384.519
209	Station 125, on top of coping, end of W. wing tow-path abutment of bridge, marked ⊕-BM with chisel	" 12.802	" 384.964
210	Station 160¾, on top of stone under coping, W. end of tow-path abutment of farm bridge (near corner), marked ⊕, and BM (on end of stone) with chisel..	" 11.914	" 384.076
211	Lower miter-sill of lock No. 41, at heel of N. E. gate, N. lock........	' 0.000	" 372.162
212	On coping, lock No. 41, at end of anchor N. E. gate, N. lock, marked ⊕-BM with chisel	+16.850 lower level " 8.564 upper level	" 389.012

213	Station 30, on top of coping, end of E. wing tow-path abutment of farm bridge, marked ⊕–BM with chisel	+12.861	" 393.309
214	Station 109, on lower step, E. end of tow-path abutment of Herkimer road bridge, marked ⊕ with chisel	" 9.994	" 390.442
215	Station $180\frac{1}{4}$, on footing course at E. end of tow-path abutment, street railroad bridge, marked ⊕, and on end of stone above BM with chisel	" 9.511	" 389.959
216	Lower miter-sill, lock No. 42, at heel of N. E. gate, N. lock	" 0.000	" 380.448
217	On coping, lock No. 42, at end of anchor, N. E. gate, N. lock, marked ⊕–BM with chisel	" 16.670 lower level " 8.716 upper level	" 397.118
218	Lower miter-sill, lock No. 43, at heel of N. E. gate, N. lock	+0.000	" 388.402
219	On coping, lock No. 43, at end of anchor, N. E. gate, N. lock, marked ⊕–BM with chisel	" 16.500 lower level " 8.431 upper level	" 404.902
220	Station 31, on top of coping at end of E. wing of tow-path abutment of farm bridge, marked ⊕–BM with chisel	+ 12.554	" 409.025
221	Station $67\frac{1}{2}$, top of coping at end of E. wing tow-path abutment of bridge, marked ⊕–BM (on face) with chisel	" 13.124	" 409.595
223	Station 130, on top of coping of parapet of aqueduct at W. end, marked ⊕, and (on face) BM with chisel	" 12.087	" 408.558
224	Station $150\frac{1}{4}$, on top of coping, end of E. wing tow-path abutment of farm bridge, marked ⊕, and (on face) BM with chisel	" 12.864	" 409.335
225	Station $185\frac{1}{2}$, on lower step on E. end of tow-path abutment of road bridge, marked ⊕, and (on face) BM with chisel	" 11.772	" 408.243
226	Lower miter-sill, lock No. 44, at heel of N. E. gate, N. lock	" 0.000	" 396.471
227	On coping of lock No. 44, at end of anchor, N. E. gate, N. lock, marked ⊕–BM with chisel	" 19.970 lower level " 9.233 upper level	" 416.441
228	Station $45\frac{1}{2}$, at end of E. wing tow-path abutment of farm bridge on corner of fourth stone under coping, marked ⊕, and on stone above BM with chisel	+ 11.808	" 419.016

LIST OF BENCH MARKS — (*Continued*).

No.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
229	Station 77¼, on face of tow-path abutment of farm bridge, on projection of fifth course from top, marked ⊕, and (on stone above) BM with chisel	+ 11.769	+ 418.977
230	Lower miter-sill, lock No. 45, at heel of N. E. gate, N. lock	" 0.000	" 407.208
231	On coping, lock No. 45, at end of anchor, N. E. gate, N. lock, marked ⊕–BM with chisel	+20.130 lower level " 8.958 upper level	" 427.338
232	Station 37, on stone under coping, end of E. wing, berme abutment of farm bridge, marked ⊕–BM with chisel	+ 11.534	" 429.934
233	Station 74¾, at W. end of berme abutment of farm bridge, marked ⊕–BM with chisel	" 11.573	" 429.973
234	Station 96½, on top of coping at end of W. wing berme abutment of farm bridge, marked ⊕–BM with chisel	" 11.906	" 430.306
235	Station 139½, lower step, W. end of tow-path abutment of farm bridge, marked ⊕–BM at every station with chisel	" 12.875	" 431.275
236	Station 187¼, on lower step, W. end of tow-path abutment of farm bridge, marked ⊕, and (on face) BM with chisel	" 12.734	" 431.134
237	Station 218, on face of tow-path abutment near W. angle on projection of sixth course from top, marked BM–⊕ with chisel	" 11.847	" 430.247
238	Station 296¾, on face of tow-path abutment of farm bridge on projection of seventh course from top near E. angle, marked ⊕–BM with chisel	" 11.247	" 429.697
239	Station 328¼, on face of W. wing tow-path abutment of farm bridge near W. angle projection of seventh course below coping, marked ⊕–BM with chisel	" 10.326	" 428.726

240	Station 364, on face of tow-path abutment of farm bridge, projection of fifth course below coping, marked ⊕–BM with chisel..........	" 12.737	" 431.137
241	Station 387¼, top of lower step at end of W. wing tow-path abutment of farm bridge, marked ⊕, and (on face) BM with chisel..........	" 13.307	" 431.707
243	Station 452, on top of coping of parapet, at end of E. wing tow-path side Ferguson creek aqueduct, marked ⊕–BM with chisel........	" 9.330	" 427.730
244	Station 495½, on lower step, E. wing tow-path abutment of farm bridge, marked ⊕–BM with chisel..................................	" 11.898	" 430.298
...	Three chains west of Oneida county line (on middle division) on lower step of E. wing tow-path abutment of Green bridge, marked ⊕, and (on face) ⊕–BM with chisel............................	" 13.619	" 432.019

LIST OF BENCH MARKS ON CHAMPLAIN CANAL.

No.	LOCATION AND DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
1	Coping, lock No. 1, S. E. gate anchor	lower level +20.64 upper level " 9.25	+ 37.98
2	Lower miter-sill, lock No. 1	0.00	" 17.34
3	Coping of lock No. 2. S. E. gate anchor	lower level "20.61 upper level " 9.14	" 49.34
4	Lower miter-sill, lock No. 2	0.00	" 28.73
5	Coping of lock No. 3, S. W. gate anchor	lower level "11.06 upper level "10.16	" 51.26
6	Lower miter-sill, lock No. 3.	0.00	" 40.20
7	Coping, lock No. 4, N. E. gate anchor	"14.20	" 55.30
8	Lower miter-sill, lock No. 4	0.00	" 41.10
9	Coping, S. W. recess angle, upper combined lock at Waterford	" 7.72	" 48.82
10	Coping, lock No. 5, S. E. gate anchor.	lower level "20.92 upper level " 7.13	" 62.02
11	Lower miter-sill, lock No. 5.	" 0.28	" 40.82
12	Lower miter-sill, lock No. 6	0.00	" 54.09
13	Coping, lock No. 7, S. E. gate anchor.	lower level "17.50 upper level " 8.27	" 82.94
14	Lower miter-sill, lock No. 7	0.00	" 65.44
15	Coping, lock No. 8, S. E. gate anchor	lower level "19.97 upper level " 8.88	" 94.64
16	Lower miter-sill, lock No. 8	0.00	" 74.67
17	Lower step, S. W. corner tow-path abutment, bridge No. 17, marked ⊕.	" 8.97	" 94.73
18	Lower step, S. W. corner tow-path abutment, bridge No. 18, marked ⊕.	"10.87	" 96.63
19	S. E. corner (water-table) hosiery mill in Mechanicville	"10 36	" 96.12

20	Lower step, N. W. corner tow-path abutment, bridge No. 23, marked ⊕	+10.64	" 96.40
21	Coping waste-weir, first north of Mechanicville, N. abutment S. E. corner, marked ⊕	" 7.76	" 93.52
22	Lower step, N. E. corner berme abutment, bridge No. 24, marked ⊕.	" 10.44	" 96.20
23	Lower step, S. E. corner tow-path abutment, Fitchburgh railroad bridge, marked ⊕	" 7.75	" 93.51
24	Coping, lock No. 9, gate anchor	lower level " 17.08 upper level " 8.78	" 102.84
25	Lower miter-sill, lock No. 9	0.00	" 85.76
26	Lower step, S. E. corner berme abutment, bridge No. 26, marked ⊕.	" 12.69	" 106.75
27	Lower step, N. E. corner berme abutment, bridge No. 27, marked ⊕.	" 8.64	" 102.70
28	Third step from top S. E. corner berme abutment, bridge No. 28, marked ⊕	" 14.98	" 109.04
29	Coping, Lansing's waste-weir, south end east stone, marked ⊕	" 9.21	" 103.27
30	Coping, Lansing's waste-weir, north end east stone, marked ⊕	" 9.01	" 103.07
31	Lower step, S. W. corner tow-path abutment, bridge No. 32, marked ⊕	" 9.77	" 103.83
32	Third stone from south end, second course tow-path abutment, bridge No. 33, marked ⊕	" 9.58	" 103.64
33	Lower step, N. E. corner berme abutment, bridge No. 36, marked ⊕.	" 11.91	" 105.97
34	Middle abutment, Bemis Heights, waste-weir, S. E. corner marked ⊕	" 9.94	" 104.00
35	Second step from bottom, N. E. corner berme abutment bridge No. 40, marked ⊕	" 10.95	" 105.01
36	Coping, Wilber's basin waste-weir, south end N. E. corner marked ⊕	" 8.47	" 102.53
37	Coping, waste-weir No. 7, north end S. E. corner, marked ⊕	" 9.81	" 103.87
38	Second step from bottom N. E. corner berme abutment, bridge No. 52, marked ⊕	" 13.03	" 107.09
39	Coping, Coveville waste-weir, south end N. E. corner, marked ⊕	" 9.14	" 103.20
40	BM on nail in root of ash tree 150 feet south of old abutment on abandoned canal at Coveville improvement	" 9.11	" 103.17

LIST OF BENCH MARKS — (*Continued*).

No.	LOCATION AND DESCRIPTION.	Elevation above C.B.	Elevation above T. W.
41	Lower step, N. W. corner tow-path abutment, bridge No. 57, marked ⊕	+13.76	" 107.82
42	Second step from bottom, N. W. wing wall T. P. abutment, bridge No. 61, Ferry street, Schuylerville	" 12.65	" 106.71
43	Lower step, S. W. corner tow-path abutment, bridge No. 62, marked ⊕	" 12.47	" 106.53
44	Second step from bottom, N. W. corner tow-path abutment, bridge 63, marked ⊕	" 13.66	" 107.72
45	Lower step, S. W. corner tow-path abutment, bridge No. 64, marked ⊕	" 13.95	" 108.01
46	Coping, lock No. 10, S. E. gate anchor	" 15.64	" 109.70
47	Lower miter-sill, lock No. 10	0.00	" 94.06
48	Coping, lock No. 11, S. E. gate anchor	" 9.11	" 113.00
49	Lower step, S. W. corner berme abutment, bridge No. 67, marked ⊕	" 10.92	" 114.81
50	Lower step, N. W. corner berme abutment, bridge No. 68, marked ⊕	" 12.72	" 116.61
51	Coping, lock No. 12, S. E. gate anchor	lower level " 18.00 upper level " 8.42	" 121.89
52	Lower miter-sill, lock No. 12	0.00	" 103.89
53	Lower step, N. W. corner berme abutment, bridge No. 71, marked ⊕	" 8.78	" 122.25
54	Lower step, N. W. corner, berme abutment, bridge No. 72, marked ⊕	" 9.20	" 122.67
55	Lower step, N. E. corner, berme abutment, bridge No. 74, marked ⊕	" 9.77	" 123.24
56	Coping, lock No. 13, S. W. gate anchor	lower level " 19.05 upper level " 9.23	" 132.52
57	Lower miter-sill, lock No. 13	0.00	" 113.47
58	Lower step, N. W. corner berme abutment, bridge No. 76, marked ⊕	" 9.97	" 133.26
59	Lower step, N. W. corner berme abutment, bridge No. 78, marked ⊕	" 9.95	" 133.24
60	Lower step, N. W. corner berme abutment, bridge No. 79, marked ⊕	" 10.27	" 133.56

61	Lower step, S. corner berme abutment, bridge No. 81, marked ⊕		" 10.91	" 134.20
62	Lower step, W. corner berme abutment, bridge No. 82, marked ⊕		" 14.21	" 137.50
63	Coping, lock No. 14, S. E. gate anchor	lower level upper level	" 17.96 " 8.71	" 141.25
64	Lower miter-sill, Lock No. 14		0.00	" 123.29
65	Lower step, W. corner berme abutment, bridge No. 84, marked ⊕		" 12.53	" 145.07
66	Lower step, S, corner berme abutment, bridge No. 85, marked ⊕		" 10.47	" 143.01
67	Lower step, S. W. corner berme abutment, bridge No. 86, marked ⊕		" 10.08	" 142.62
68	Lower step, S. W. corner berme abutment, bridge No. 87, marked ⊕		" 10.16	" 142.70
69	Lower step, N. E. corner tow-path abutment, bridge No. 88, marked ⊕		" 9.82	" 142.36
70	Lower step, S. E. corner berme abutment, bridge No. 90, marked ⊕		" 7.93	" 140.47
71	Second step, S. E. corner tow-path abutment, bridge No. 91, marked ⊕		" 9.48	" 142.02
72	Lower step, S. W. corner berme abutment, bridge No. 92, marked ⊕		" 9.29	" 141.83
73	Top of masonry, N. side tow-path abutment, bridge No. 93, marked ⊕		" 15.60	" 147.14
74	Lower step, S. W. corner berme abutment, bridge No. 94, marked ⊕		" 8.50	" 141.04
75	Lower step, N. corner berme abutment, bridge No. 95, marked ⊕		" 9.58	" 142.12
76	Second step, N. corner berme abutment, bridge No. 96, marked ⊕		" 10.12	" 142.66
77	Lower step, inner corner N. side east abutment, bridge No. 97, marked ⊕		" 8.93	" 141.47
78	Lower step, N. side, tow-path abutment, bridge No. 98, marked ⊕		" 9.22	" 141.76
79	Coping, lock No. 15, S. E. gate anchor	lower level upper level	" 16.85 " 8.59	" 149.39
80	Lower miter-sill, lock No. 15		0.00	" 132.54
81	Upper miter-sill, lock No. 15		—1.38	" 138.42
82	Lower step, S. W. corner tow-path abutment, bridge No. 100, marked ⊕		+ 9.87	" 150.67
83	First step, N. E. corner berme abutment, bridge No. 101, marked ⊕		" 12.96	" 153.76
84	Coping, S. W. gate anchor, lock No. 16	lower level upper level	" 16.90 " 8.62	" 149.42

LIST OF BENCH-MARKS — (*Continued*).

No.	LOCATION AND DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
85	Upper miter-sill, lock No. 16	—1.33	" 138.47
86	Lower miter-sill, lock No. 16	0.00	" 132.52
87	Coping, N. E. gate anchor, lock No. 17	lower level +16.95 upper level " 8.83	" 141.35
88	Lower miter-sill, lock No. 17	0.00	" 124.40
89	Coping, N. E. gate anchor, lock No. 18	lower level " 16.10 upper level " 9.00	" 133.40
90	Lower miter-sill, lock No. 18	0.00	" 117.30
91	Coping N. W. gate anchor, lock No. 19	lower level " 12.50 upper level " 10.39	" 127 69
92	Lower miter-sill, lock No. 19	0.00	" 115 19
93	.Coping lock No. 20, N. W. gate anchor	lower level " 13.00 upper level " 12.86	" 128 05
94	Lower miter-sill, Lock No. 20	0.00	" 115 05
95	Fourth course from top N. end berme abutment, bridge No. 124, marked ⊕	" 13.15	" 128 20
96	Fifth course from top S. E. corner S. end berme abutment, bridge No. 126, marked ⊕	" 11.62	" 126 67
97	Sixth course from top S. E. corner S. end berme abutment, bridge No. 127, marked ⊕	" 11.08	" 126 13
98	Seventh course from top N.W. corner N. end tow-path abutment, bridge No. 128, marked ⊕	" 10.32	" 125 37
99	Sixth course from top N.W. corner N. end tow-path abutment, bridge No. 130, marked ⊕	" 12.34	" 127 39

100	Eighth course from top N.W. corner N. end tow-path abutment, bridge 131, marked ⊕		" 9.22	" 124.29
101	Fourth course from top N. E. corner N. end berme abutment, bridge No. 132, marked ⊕		" 11.35	" 126.40
102	Fifth course from top S. E. corner S. end berme abutment, bridge No. 133, marked ⊕		" 10.35	" 125.40
103	Seventh course from top N. W. corner N. end tow-path abutment, bridge No. 135, marked ⊕		" 9.16	" 124.21
104	N. end of wing N. W. corner lower course tow-path abutment, railroad bridge, marked ⊕		" 8.90	" 123.95
105	Sixth course from top N. W. corner N. end tow-path abutment, bridge No. 137, marked ⊕		" 10.16	" 125.21
106	S. end tow-path abutment S. W. corner lowest course D. and H. iron railroad bridge		" 10.66	" 125.71
107	Seventh course from top N. W. corner N. end tow-path abutment, bridge No. 148, marked ⊕		" 11.06	" 126.11
108	Coping lock No. 21, N. E. gate anchor	Upper level	" 7.60	" 122.65

NOTE. — For summit level between locks 15 and 16 canal bottom is taken as 140.8 + T. W.

LIST OF BENCH MARKS ON GLENS FALLS FEEDER.

No.	LOCATION AND DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
1	Lower miter-sill, lock No. 1	Cham. canal +1.3	+142.11
2	Coping N. E. gate anchor, lock No. 1	lower level "15.82 upper level " 5.7	" 157.93
3	Lower miter-sill, lock No. 2	0.0	" 152.23
4	Coping N. E. gate anchor, lock No. 2	lower level "15.86 upper level " 5.81	" 168.09
5	Lower miter-sill, lock. No 3	0.0	" 162.28
6	Coping N. E. gate anchor, lock No 3	lower level "16.00 upper level " 5.19	" 178.28
7	Lower miter-sill, lock No. 4	0.0	" 173.09
8	Coping N. E. gate anchor, lock No. 4	lower level "15.38 upper level " 5.35	" 188.47
9	Lower miter-sill, lock No. 5	0.0	" 183.12
10	Coping N. E. gate anchor, lock No. 5	lower level "15.54 upper level " 5.13	" 198.64
11	Lower miter-sill, lock No. 6	0.0	" 193.51
12	Coping N. E. gate anchor, lock No. 6	lower level "15.32 upper level " 5.29	" 208.83
13	Lower miter-sill, lock No. 7	0.0	" 203.54
14	Coping N. E. gate anchor, lock No. 7	lower level "15.83 upper level " 5.07	" 218.92
15	Lower miter-sill, lock No. 8	0.0	" 213.85
16	Coping N. E. gate anchor, lock No. 8	lower level "15.27 upper level " 5.52	" 229.12
17	Lower miter-sill, lock No. 9	0.0	" 223.60

18	Coping N. E. gate anchor, lock No. 9	lower level " 15.49 upper level " 5.61	" 239.09
19	Lower miter-sill, lock No. 10	0.0	" 233.48
20	Coping N. E. gate anchor, lock No. 10	lower level " 15.52 upper level " 5.08	" 249.00
21	Lower miter-sill, lock No. 11	0.0	" 243.92
22	Coping N. E. gate anchor, lock No. 11	lower level " 16.96 upper level " 6.86	" 260.88
23	Lower miter-sill, lock No. 12	0.0	" 254.02
24	Coping N. E. gate anchor, lock No. 12	lower level " 15.87 upper level " 5.16	" 269.89
25	Lower miter-sill, lock No. 13	0.0	" 264.73
26	Coping N. E. gate anchor, lock 13	lower level " 15.55 upper level " 5 18	" 280.28
27	Top of breast-wall, lock No. 13	—1.40	" 273.70
28	Lower step, tow-path abutment, bridge No 3, marked ⊕	+10.06	" 285.16
29	Second step, S. E. corner north abutment, bridge No. 4, marked ⊕	" 12.17	" 287.27
30	Second step, N. W. corner south abutment, bridge No. 4, marked ⊕	" 10.14	" 285.24
31	Second step, S. W. corner tow-path abutment, bridge No. 5, marked ⊕	" 7.91	" 283.01
32	On west end tow-path abutment, bridge No. 6, marked ⊕	" 9.03	" 284.13
33	On west end tow-path abutment, bridge No. 7, marked ⊕	" 10.23	" 285.33
34	On west end tow-path abutment, bridge No. 8, marked ⊕	" 10.09	" 285.19
35	On wing wall, near east end berme abutment, bridge No. 9, marked ⊕	" 10.74	" 285.84
36	Second step, east end berme abutment, D. & H. R. R. bridge, marked ⊕	" 9.34	" 284.44
37	On west end tow-path abutment, bridge No. 10, marked ⊕	" 9.67	" 284.77
38	Top of stone foundation of trestle, west end, in rear of Finch & Pruyn's office, in Glens Falls, marked ⊕	" 9.71	" 284.81
39	On east end tow-path abutment, bridge No. 11, marked ⊕	" 12.33	" 287.43
40	On projecting stone at west end tow-path abutment, Morgan's bridge, (first west of bridge No. 11), marked ⊕	" 13.40	" 288.50

LIST OF BENCH MARKS — (*Continued*).

No.	LOCATION AND DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
41	On east end tow-path abutment, abandoned bridge, first east of bridge No. 12, marked ⊕	+7.42	+282.52
42	Lower step, W. end tow-path abutment, bridge No. 12, marked ⊕	" 9.23	" 284.33
43	Lower miter-sill, lock No 14	0.0	" 275.10
	Coping lock No. 14, north wall, east end, marked ⊕	" 10.63	" 285.73
	Water-surface at foot of lock No. 14	" 5.91	" 281.01

NEW YORK STATE CANALS,

MIDDLE DIVISION.

REPORT OF HENRY T. BEACH,

ACTING DIVISION ENGINEER,

FOR THE

YEAR ENDING SEPTEMBER 30, 1888.

MIDDLE DIVISION.

ANNUAL REPORT OF THE DIVISION ENGINEER FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1888.

SYRACUSE, N. Y., *October* 1, 1888.

Hon. JOHN BOGART,
State Engineer and Surveyor:

I have the honor to submit the annual report of the middle division for the fiscal year ending September 30, 1888.

	Miles.	Totals.
This division comprises that portion of the Erie canal lying between the east line of Oneida and Wayne counties	97.02	
Also, the following unabandoned lateral canals:		
Oswego canal, from Syracuse to Oswego	38.00	
North and south side-cuts and slips at Salina	2.00	
Slips at Liverpool, Oswego canal	.21	
Baldwinsville side-cut	.75	
Cayuga and Seneca canal, Montezuma to Cayuga and Seneca lakes	22.77	
Black River canal, Rome to Lyons Falls	35.33	
Old Oneida Lake canal, Higginsville to first lock	1.05	
New Oneida Lake canal, Durhamville to Oneida lake (not used)	5.30	
Chénango canal, from Erie canal to lock No. 1	.15	
		202.58
RIVER IMPROVEMENTS.		
Black river, Lyons Falls to Carthage	42.50	
Onondaga outlet, Onondaga lake to Seneca river	.75	
Oneida river, Three River Point to Brewertown and Oneida lake	20.00	
Seneca river towing-path, Mud lock to Baldwinsville,	5.75	
Seneca river, Baldwinsville to Jack's Reefs (not used)	11.75	
Ithaca inlet, Cayuga lake to Ithaca	2.05	
Seneca lake outlet, from Cayuga and Seneca canal to Seneca lake	.26	
		83.06

NAVIGABLE FEEDERS.

	Miles.	Totals.
Limestone creek feeder, Erie canal to Fayetteville....	.80	
Butternut creek feeder, Erie canal to feeder dam above Dunlap's mills	2.00	
Nine-mile creek (Camillus) feeder, Erie canal to Camillus	1.00	
Delta feeder, foot of lock nine, Black River canal to delta	1.38	
Black river feeder, Boonville to head of pond at Forestport	12.09	
		17.27
Total		302.91

ARTIFICIAL FEEDERS — NOT NAVIGABLE.

Chenango canal, from lock No. 1 to lock No. 77	26.72
Leland pond feeder	.32
Madison brook feeder	3.00
West branch feeder	5.74
Bradley's brook feeder	.65
Hatch's lake feeder	.23
Kingsley brook feeder	1.93
Oriskany creek feeder	.53
Mohawk feeder at Rome	.05
Oneida creek feeder	3.04
Cowassalon creek feeder	.38
Chittenango creek feeder	.28
Cazenovia lake outlet (improved)	.49
Tioughnioga river feeder	.70
De Ruyter reservoir outlet	.12
Butternut creek (Orville) feeder	.55
Nine-mile creek (Camillus) feeder, (portion of same unnavigable)	.65
Carpenter brook feeder	.18
Skaneateles creek feeder	.10
Putnam brook feeder	.20
Centerport feeder	.24
Owasco creek feeder (including 859 feet of iron pipe)	2.10
New outlet of Third Bisby lake	.06
New outlet of Canachagala lake	.16
Total	48.42

WATER SUPPLY.

The canals upon this division are supplied with water from the following named sources:

Erie Canal — Frankfort and Rome Levels.

(Three and three hundred and fifty-six thousandths miles of Frankfort level on middle division. The Rome level, lock No. 46 to No. 47 = 55.957 miles.)

	Cubic feet per minute.
Leland's pond, Madison brook reservoir, Eaton brook reservoir, Bradley brook reservoir, Hatch's lake, Kingsley brook reservoir and Oriskany creek feed through the Chenango canal into Frankfort level, at Utica, and through Oriskany creek feeder into the Rome level, six miles west of lock No. 46	6,000
Mohawk river, Black river, Forestport pond, White lake reservoir, first, second and third Bisby lakes, Canachagala lake, North Branch reservoir, South Branch reservoir and Twin lakes feed through the Rome feeder and Black river canal into the Rome level at Rome, fourteen miles west of lock No. 46	13,000
Oneida creek enters canal through feeder, thirty miles west of lock No. 46	1,000
Cowassalon creek enters canal through feeder, thirty-one and a half miles west of lock No. 46	200
Cazenovia lake reservoir (for 100 days), Erieville reservoir (for 100 days), and Chittenango creek enter canal through Chittenango creek feeder, forty-one and a half miles west of lock No. 46	5,641
De Ruyter reservoir (for 100 days) enters canal through Limestone creek (Fayetteville) feeder, fifty miles west of lock No. 46	3,891
Limestone creek (natural flow) enters canal through Limestone creek (Fayetteville) feeder, fifty miles west of lock No. 46	500
Jamesville reservoir (for sixty days) enters canal through Butternut (Orville) feeder, fifty-two miles west of lock No. 46	2,000
Butternut creek (natural flow) enters canal through Butternut (Orville) feeder, fifty-two miles west of lock No. 46	500
Total	32,732

Short level, from lock No. 47 to No. 48 = .188 of a mile; fed from Rome level.

Mile level, from lock No. 48 to 49 = .714 of a mile; fed from Rome level through short level.

Syracuse level, from lock No. 49 to 50 = 5.014 miles; fed from Rome and Jordan levels.

Jordan level, from lock No. 50 to 51 = 14.903 miles.

	Cubic feet per minute.
Otisco lake reservoir feeds through Nine-mile creek (Camillus) feeder into canal, four miles west of lock No. 50	5,146
Nine-mile creek fed through Nine-mile creek (Camillus) feeder into canal, four miles west of lock No. 50	800
Carpenter brook enters canal through feeder, ten miles west of lock No. 50	200
Skaneateles lake reservoir feeds into canal at Jordan thirteen miles west of Lock No. 50	8,766
Total	14,912

Port Byron level, from lock No. 51 to 52 = 7.793 miles from Jordan level, through lock No. 51.

Putnam brook feeder, at Weedsport	200
Owasco lake reservoir, through feeder at Port Byron	4,033
Total	4,233

Montezuma level, from lock No. 52 to Wayne county = 9.098 miles. From Port Byron level, through lock No. 52.

Lake Erie	4,000

Oswego Canal.

Erie canal at Syracuse	10,000
Seneca river	54,000
Oneida river	20,000
Total	84,000

Cayuga and Seneca Canal.

Seneca lake	18,000
Erie canal at Montezuma	4,000
Total	22,000

SUMMARY OF WATER SUPPLY MEASURED.

	Cubic feet per minute.	
	Amounts.	Totals.
Erie Canal.		
Frankfort and Rome levels	32,732	
Jordan level	14,912	
Port Byron level	4,233	
Montezuma level	4,000	
		55,877
Oswego Canal.		
From Seneca river	54,000	
From Oneida river	20,000	
		74,000
Cayuga and Seneca Canal.		
From Seneca river	18,000	
		18,000
		147,877

NOTE.—This does not include water used more than once.

BLACK RIVER CANAL AND RIVER IMPROVEMENT.

CANAL.	Elevation in feet above tide water.	Surface area in acres.	Average area in acres.	Average depth in feet.	Capacity in cubic feet.
White Lake reservoir	....	....	296	5	64,468.800
Chubb Lake reservoir (approximate).	1,599	....	200	4	34,848.000
Sand Lake reservoir	....	....	306	15	199,940.400
Woodhull reservoir (two y'rs in filling)	1,854	1,236	1,118	18	876,601.440
First, Second and Third Bisby lakes (approximate)	....	....	....	3½	40,000.000
Canachagala lake (approximate)	....	....	320	4	55,756.800
North Lake reservoir (can fill twice yearly)	1,821	423	277	28	337,851.360
South Lake reservoir	2,019	518	372	26	421,312.320
Twin Lakes reservoir (approximate).	....	....	175	8	60,984.000
Forestport pond	....	....	....	....	....
Mohawk river, through Delta feeder.	....	....	....	....	....
Pond above Lyon's Fall dam	....	....	....	....	....
RIVER IMPROVEMENTS.					
Forge pond	....	....	....	....	....
First lake of the Fulton chain	1,691	....	....	....	....
Second lake of the Fulton chain	1,691	....	....	....	....
Third lake of the Fulton chain	1,691	....	....	....	....
Fourth lake of the Fulton chain	1,691	....	....	....	....
Fifth lake of the Fulton chain	1,691	9	....	....	....
Sixth lake of the Fulton chain	1,772	109	....	....	....
Seventh lake of the Fulton chain	1,772	867	....	....	....
Eighth lake of the Fulton chain	1,776	309	....	....	....
Black river	....	....	....	....	....
Moose river	....	....	....	....	....
Beaver River reservoir	....	....	....	....	....

There has been no change in the water supply during the fiscal year.

NAVIGATION, ETC.

The Erie, Oswego, Cayuga and Seneca and Black River canals opened officially May tenth. All were ready for navigation on the date appointed.

No delay or breaks of a serious character have occurred on this division, and navigation has continued so far uninterrupted. The water supply has been scarcely sufficient to meet all demands upon it, the heavy leakages, combined with a rather dry season, having made a large supply necessary to keep the levels up to the established height. This division depends, more than any other, upon an artificial supply, and much care is required to keep the reservoirs so drawn that advantage can be taken of heavy rains, by storing their surplus, and also to draw the storage basins no lower than experience has shown is necessary to insure a full reservoir for the succeeding year. The Jordan, a summit level, and the Rome, or long level, also a summit level, are the most difficult to maintain at a proper height, as other levels are fed from these. Since the construction of the Otisco lake reservoir, the supply of the Jordan level has been equal to the demands of a dry season. For the Rome level, however, an additional reservoir seems to be absolutely necessary to insure a full supply. It should be so located that the water can reach the canal in as short a time as possible after the feeding gates are raised. The best site for such a reservoir is, without doubt, on the Black river, at the head of the Forestport pond, as described and recommended in previous reports. The necessity for this is strikingly shown by the experience of the past two seasons. In both years navigation opened with full reservoirs, but, before the fall rains came, the reservoirs were drawn so low that, although the water had been husbanded with the greatest care, the full amount needed could not be furnished. In 1887 the question was seriously considered whether it would not be best to send a force into the woods to open a channel from one of the unappropriated lakes, but a timely heavy storm averted the danger.

This year the same condition threatened, and was again narrowly escaped. A portion of the work on the proposed Forestport dam has been done. I renew the recommendation for its early completion. (Twenty-four hours full draft will empty the present Forestport pond.)

The capacity of the Oriskany feeder, supplying the Rome level, can be materially increased and the Kingsley brook reservoir made much more available by a comparatively small expenditure.

The Kingsley brook reservoir discharges into and runs a short distance in the channel of the natural stream to a point where it is diverted by a dam into an artificial feeder. About two miles below this dam the waters from Hatch's lake and Bradley brook and Eaton reservoirs enter the same channel at an elevation so near that of the Kingsley brook dam, that a backwater is produced greatly retarding the flow from the latter. By raising the dam and the banks of the artificial feeder, this difficulty can be obviated. The Oriskany feeder proper from the State dam to the canal, about one-half mile, should also be enlarged.

The pipes under the earth dam forming the Kingsley brook reservoir do not extend through the embankment, but end some distance from the lower slope. The valves are under the dam and in order to open them, it is necessary to go through a long damp culvert in which the air is so bad that lamps go out.

Our only plan shows the pipes extending through the embankment with valve-house and valves easily accessible; this plan was not carried out. I recommend the completion of pipes, valve-houses, etc., on this plan.

The dam at Jamesville reservoir rests in part on ledge limestone with irregular clay seams between the courses of solid stone. The water discharged from the spill-way near the east end rushes down with great force, in high water, along the face and foot of the dam, wearing out the clay seams.

A failure of this dam would not only cause a serious dearth of water and damage to State property, but carry destruction through the valley of Butternut creek.

While I do not believe this danger to be imminent, I think it would be best to assure the safety of the structure by diverting the rush of water from the immediate face of the masonry.

This could be done by blasting a sufficient channel entirely clear of the dam or by building a masonry slope along the foot of the dam. Perhaps both would be advisable.

I recommend that this be done at low water next summer, when a thorough examination could be made and the necessary measures accurately determined.

All the masonry in the various reservoirs, dams, etc., should be pointed and otherwise repaired.

On the Oswego canal during low water, there is great difficulty in obtaining sufficient feed through the guard-locks, owing to extremely low head. The valves in gates of these locks should be enlarged from 4×2½ feet to 4¾×3 feet, or supplemental feed valves provided, to compensate for decreased head.

The Beaver river reservoir has only partially accomplished its object — owing in great measure to the fact that the flow line is but slightly above the larger part of the flowed lands, giving only a depth of one to two feet over large areas. An additional elevation to dam of three or four feet would greatly increase the storage capacity, without materially adding to the acreage of pond.

The survey of this reservoir was suspended when only about half completed. Provisions should be made to finish it.

MACHINERY FOR DRAWING BOATS INTO LOCKS.

The device for drawing in loaded boats that has continued to work so successively on the Erie double locks was remodeled for the Oswego locks, but has not been applied. Without the machinery, which is operated by surplus water from the canal, the passing of loaded boats through lengthened locks, having an upward lift toward tide-water, is difficult and slow, especially when the locks are only standard width (eighteen feet at water line of lower level). The workmanship and form of construction was so perfect that the experience of two seasons' navigation has suggested no important changes, and only a few alterations that would slightly cheapen the cost of construction, or were necessary to adapt the device to the single tier of locks used on the Oswego canal, have been made in preparing plans for the locks to be built on that canal under new appropriations.

I would recommend the placing of this machinery on all the lengthened locks of the Oswego canal, except guard-locks, which being three feet extra width and having a small lift, do not particularly need it.

IMPROVEMENT OF CHANNEL.

Following this, as a part of the same system, the Legislature should, in my opinion, make liberal appropriations for the channel itself, by providing for the removal of the deposits and accumulations that have gradually encroached upon the original dimensions of the prism, notwithstanding the efforts of the superintendents, who, with limited means and time for such work, have each spring endeavored only to make as good a channel as possible under the circumstances.

On Erie canal, cross-sections show that the center of the channel is kept clean, and is generally below the canal bottom, owing to the action of the boats; but at the sides a bench is formed, which, if removed, would give a better channel than was afforded by the new canal when first enlarged. Dredges could, no doubt, be used to good advantage to remove the heavy bench generally found on the berme side, and the material deposited by means of a chute so as to strengthen and raise the banks. This kind of work is now greatly needed on some portions of the Jordan level, for which provision has been made, and could be beneficially done on the greater portion of the division.

On the Oswego canal (except the Liverpool level, which has been dredged during the fiscal year, and the various river levels where little deposit occurs), the condition is much worse than on the Erie. On nearly all the "canal" levels proper, the bottom, as well as the sides, is filled to a depth of six inches or a foot, rendering it necessary to carry the water-surface higher to that extent than was originally intended in order to pass loaded boats. This condition not only operates to impede navigation, but to the injury of the canal banks by reducing the relative height of bank from water-surface, thus increasing the destructive action of waves and swells, and requiring increased watchfulness to prevent flooding the banks. It also reduces the clearance under bridges, causing frequent collisions with light boats.

I therefore recommend a liberal appropriation for this work, which, in my opinion, is far more essential to the improvement of the Oswego canal than the lengthening of locks, although that is undoubtedly a great benefit. The canal levels are general short, so the material, when not needed, or unsuitable for strengthening banks, could be cheaply disposed of in the deep portions of the river.

On all sections of the Erie canal gravel-scows have been constantly at work, and a recent inspection shows plainly the evidences of the good work they are doing. The use of a road-scraper has been found of great service in restoring the tow-path to its former shape, as the natural wear tends to hollow out the center and leave a ridge in the rear of the traveled-path preventing drainage. The State dredges on the Erie and Black River canals have been kept busy in removing bars wherever they are found to interfere with navigation. About August tenth, they began work, at Ithaca, in Cayuga lake inlet.

STRUCTURES.

The structures are generally in very good conditions. The bridges, particularly, have been kept in good repair. Many of them, however, need painting. In renewing the wood-work of the floors of iron bridges, the cleaning and painting of the iron-work is apt to be neglected at the only time when it can be thoroughly done. The difficulty of obtaining good bridge-timber now, and the small difference in cost between wooden and iron bridges, should prevent the reërection of wooden superstructures on the canal as a matter of economy. It is difficult to tell just when a wooden bridge is actually unsafe, some structures lasting much longer than others. I would recommend that some general plans of iron-bridges be adopted, as repairs to the wood-work will be more cheaply made if the floor system is uniform; and the iron-work, also, can be repaired at less expense.

The variety of forms on this division require so many sizes of timber that it is difficult to order a bill for general repairs that will be economical.

I would suggest the division of bridges into classes according to their purpose and the amount of traffic, as

City bridges, double roadway;
City bridges, single roadway;
Highway bridges, first-class;
Highway bridges, second-class;
Farm bridges;
Change bridges; or some similar classification, with a general plan, as above recommended, for each class, in which the width of roadway and, so far as practicable, length of panel would be constant in that class. These dimensions to apply to all new structures, whether to replace worn out, iron or wooden bridges, or to establish new crossings. The laws to be modified, if necessary, to permit such change of plan as might be needed, in order to conform to the general plan.

Thus these structures would be gradually brought into as near uniformity as is practicable, without material increase of expense, and the number of special structures be greatly reduced.

WALLS AND BANKS.

The wash from the swells of fast steamers still continues to damage the slope-walls and banks, particularly on the berme side, and it is only by constant watchfulness that serious breaches are prevented. In many places the slope-wall has been disarranged, leaving no protection to the softer material forming the banks. The tow-path is generally kept in good repair, but on the berme, although much has been done to strengthen the banks, they are still low and narrow in many places. In such places the slope-wall should be taken down to a point where it is in good condition and relaid to full height, the bank, at the same time, being made full, both in height and width, with sound material.

The berme bank, although the weakest part of the earth structure, receives comparatively little attention, as it is only seen when visited for special examination. Incipient breaches thus often escape notice, and are not repaired until they are serious.

The vertical walls, in many places, have become very dilapidated, generally, because of poor workmanship. This is especially the case through the city of Utica, where long stretches are tumbling down.

The foot of high banks, on both tow-path and berme, has in many places been strengthened by loading them with stone. The success of this treatment fully warrants its extension to all places where the height of bank or character of material causes danger of sloughing.

Numerous claims arise against the State every year for damage from leakage and filtration from the canal, causing great expense to the State in combating them, even when ill-founded. Most of these claims would be avoided by a thorough system of drainage ditches along the foot of slopes, with authority for the superintendent to keep them clear. At present this can only be done by special appropriation, and is, therefore, neglected, even where ditches have been made; while no new ditches are dug, except after repeated urging of their necessity. Authority and means should be given to the superintendent, to both clean the old ditches and dig new ones, whenever, in his judgment, and that of the engineers, it is necessary.

Serious trouble also frequently arises from the unsanitary condition of the old canal, which, in most cases on this division, forms stagnant pools.

A sufficient appropriation should be made to provide ample outlet and drainage of these ponds, and authority given for the proper maintenance of the necessary ditches or other means of securing this result.

RECORD OF BRIDGES.

The bridge record on the Erie, made in 1878, has become misleading, as changes have not been recorded. I would suggest a resurvey to include all the canals.

RECORD OF LEVELS, LINES AND AREAS.

The bench levels on the Erie are found defective, tests not having been made for over fifty miles. Few of the bench marks are permanently marked. I would recommend a thorough test of these levels and marking of bench marks, and the extension of the levels and bench marks to all the canals of the division.

The location of the "blue line" is very indefinite, especially in cities where it is of most importance on account of the greater value of land and consequent greater temptation to encroachment. I would recommend the reëstablishment of the "blue line," particularly through the cities and villages, and its definite location by references to permanent structures so that it may be readily and accurately retraced at any time.

The capacity of reservoirs and feeders is largely estimated. I would suggest an accurate determination of the matter as soon as practicable.

APPROPRIATION OF 1886 — ERIE CANAL.

Chapter 646.

This act provided specifically for lengthening certain locks under the general head of facilitating commerce by increasing the lockage capacity of the Erie and Oswego canals.

Locks 47 and 48, Erie canal, were two of the specified locks. Between them is a sharp curve, convex on the berme, and near the center of the level (which is very short) the Beech street (Syracuse) bridge abutment projected into the canal beyond the normal line of prism, making a very bad entrance for double boats to the lengthened locks. On this account it was decided to apply the unexpended balance of the appropriation, so far as necessary, to setting back the bridge abutment and vertical wall adjoining it to as to give a better approach to the locks. This work was put under contract February 11, 1888, and has been completed in a substantial manner.

APPROPRIATIONS OF 1887 — ERIE CANAL.

Chapter 113.

Berme lock No. 46, to be lengthened at the foot, was let June 28, 1887. Some material was delivered and a little excavation done, when work was stopped by injunction and subsequently suspended indefinitely by the Superintendent of Public Works.

The injunction has not been dissolved, consequently no work has been done since January 1, 1888.

Chapter 274.

The lift-bridge, at John street, Utica, was placed under contract November 15, 1887. It has been completed and now works satisfactorily, though at first there was considerable trouble with it. The cylinder has been rebored and other minor improvements made.

Chapter 233.

The lift-bridge at West street, Syracuse, was placed under contract March 5, 1888. It has been completed, but does not work satisfactorily. I think the main difficulty is from low pressure of water, which can only be remedied by a larger cylinder.

Some minor adjustments are necessary on both these lift-bridges, which should be done by some person familiar with their construction and operation. Probably it would be best to send a man over the whole line of the canal, as the lift-bridges on the western division also need adjustment.

Chapter 338.

Draining old canal at Rome. Nothing was done under this act, and a reappropriation, with addition, was made in 1888.

OSWEGO CANAL.

Chapter 113.

Lock No. 7 and guard-lock No. 4, both to be lengthened at the head, were let August 2, 1887, and were completed in a thorough and substantial manner, in time for the opening of the canal on May tenth.

At lock No. 7, piles were used in the foundation. No special difficulty attended the construction of this lock, except from a wooden-box culvert running lengthwise of the lock and within the lines of excavation, and from the great quantity of water to be pumped.

When the frost came out of the ground in the spring, the culvert was forced into the pit and injured, so as to require rebuilding for about fifty feet in length.

Owing to inadequate power and a lack of appreciation on the part of the contractor of the necessity for full power to handle the water economically and speedily, the progress was slow, and it was only by constant urging and a final assumption of a part of the work by the State, that the lock was completed in time for the official opening of the canal.

At guard-lock No. 4, rock-bottom was found, which appeared to be hard and continuous, consequently the same plan was adopted as at guard-lock No. 1, the previous year, viz.: Using timber foundation only under new miter-sill and gates at head of lock, building the remainder of the masonry on rock.

On letting in the water, however, to boat stone to lock No. 7, before the opening of the canal, it was discovered that the apparently solid sheet of rock had been completely shattered by the blasting formerly done in enlarging the Oswego canal. The force of water admitted tore up the rock in the chamber for some twelve or fifteen feet in length, about two feet in depth, and nearly the whole width of chamber. The concrete which had been used to level up under the walls, stood this severe test perfectly and no damage occurred to the walls. It was deemed best, however, to prevent all danger of further displacement of rock, by protecting it for a distance of sixteen feet from the upper miter-sill, with a timber apron secured by bolts with broad washers and concrete. There has been no further trouble at this lock.

This circumstance led me to examine guard-lock No. 1, at Phœnix, where I found the same condition of affairs, though not to the same extent, the water probably having been let in more carefully and under less head.

This shows that rock bottoms, where the canal has been deepened by blasting, are not to be trusted. We therefore provide for full timber foundations and concrete in such cases for future work.

Machinery to facilitate passage of boats through locks on the Oswego canal, was not let.

Bottoming out the Oswego Canal.

Under this head the work of dredging the Liverpool level had been let September 20, 1887, and was completed during this fiscal year.

Chapter 351.

State ditch at Liverpool. Nothing has been done.

CAYUGA AND SENECA CANAL.

Chapter 113.

Improving Locks Nos. 1 and 2 and removing obstructions between Waterloo dam and Seneca lake. Examinations were made in 1887, but the work not let. The appropriation was subsequently diverted by chapter 325, Laws of 1888, to the improvement of the channel of of Seneca river and the Old Bear race at Waterloo.

BLACK RIVER CANAL.

Chapter 113.

Locks 8 and 48 were let, to be rebuilt August 23, 1887, and have been completed during the fiscal year, in a thorough and substantial manner, in time for the opening of the canal, May tenth.

As the bids for the whole work exceeded the appropriation, the Superintendent of Public Works provided for the excavation of lock masonry in another manner.

In rebuilding these locks, a composite plan was adopted, the head and foot to a point a short distance from the recesses being built of bush-hammered masonry, according to the specifications adopted for lengthening the Erie canal locks, while the remainder of the chamber walls (about sixty-three feet in length on each side) were made of well scabbled rubble masonry, guarded with seven inches by ten inches oak fenders, secured to the walls by anchor bolts.

At lock No. 8, these fenders were mortised into seven inches by ten inches oak cross-sills, but at lock 48, the bottom being solid rock, the sills were omitted and the fenders let into the rock at the bottom.

The old face-stone was largely used for the face of the rubble chamber walls, but proved so brittle and faulty under the hammer, that I recommend using such stone only for backing in future work.

DREDGING THE OUTLET OF CROOKED LAKE.

Chapter 234.

This work has been completed in a satisfactory manner.

APPROPRIATIONS OF 1888 — ERIE CANAL.

Chapter 371.

Draining the old Erie canal in the city of Rome.

This work was let July 3, 1888 The greater part of the sewer pipe was delivered and a small amount of excavation done, when work was stopped by an injunction, which has not been dissolved, consequently no further work has been done.

Chapter 372.

Wall between South James street and the Black river canal along the north blue line of the Erie canal.

This work was let July 3, 1888, and is now two-thirds completed in a very satisfactory manner.

Chapter 416.

Bottoming out the Erie canal.

The work to be done at such points as the Superintendent of Public Works shall deem most important. The portion selected for this division was the Jordan level. The necessary surveys have been made, but the estimates are not complete.

Chapter 417.

Erection of a swing or lift-bridge at Schuyler street, Utica.

Survey, estimates and plans are made, but work not let.

OSWEGO CANAL.

Chapter 416.

Lengthening two or more locks and bottoming out the canal.

Guard lock No. 3 at Oswego Falls (Fulton), and lock No. 11 (Orchard lock) about one and one-half miles below Fulton were selected for lengthening, as giving the greatest benefit in connection with previous work of this character. The work was let August 8, 1888, and considerable material has been delivered. The estimated cost of the lengthening of these two locks precluded any attempt at bottoming out, at least until the actual cost is determined.

Machinery to facilitate hauling boats into the lengthened locks was advertised to be let August 8, 1888, but not let.

CAYUGA AND SENECA CANAL.

Chapter 325.

Excavating channel of Seneca river and the Old Bear race in the village of Waterloo.

This work will be prepared for letting soon.

Chapter 416.

The general improvement of the canal.

Nothing has been done except a general reconnoissance.

BLACK RIVER CANAL.

Chapter 270.

Substituting vertical wall in place of slope wall between the Black River canal and Lock street in the city of Rome.

This is an extention of the vertical wall built under chapter 550, Laws of 1886.

The work was let July 3, 1888, and is about two-thirds done in a very satisfactory manner.

Chapter 416.

Improvement of the Black River canal.

Nothing has been done except a general consideration of the most necessary work.

CHEMUNG CANAL.

Chapter 416.

Construction of a basin at Havana, and reopening the Seneca Lake level.

Estimate and plans have been made, but the work not let.

MISCELLANEOUS.

Chapter 206.

Crooked lake.—Improving outlet and removing portion of bar at Branchport.

Contract was made May 25, 1888, and the work completed satisfactorily.

Chapter 192.

Canandaigua lake.—Deepening harbor and constructing breakwater at the foot of the lake. Let August 27, 1888.

No work has been done, except in preparation.

Chapter 291.

Swing-bridge across Cayuga inlet at Buffalo street, Ithaca.

Nothing done, except a general examination.

Chapter 132.

Dredging Cayuga inlet.

Work is being done by the Superintendent of Public Works.

Chapter 367.

Removing obstructions from the Oswego river below the village of Phœnix.

Nothing has been done.

Chapter 375.

Repairing State embankment at Sherburne.

Work has been done by the Superintendent of Public Works.

Chapter 270.

Repairing road from Forestport to Woodhull.

Some work has been done under the Superintendent of Public Works.

Chapter 249 (*Surveys for Board of Claims*).

About $1,200 has been expended for surveys, maps, etc., under this act.

The following, although not connected with canals, are mentioned as possibly requiring some attention from this department.

Chapter 270, *Laws of* 1888.

Repairing roads and bridges and removing obstructions in Onondaga creek on the Onondaga Indian reservation.

Considerable work has been done by the Superintendent of Public Works.

Improving the navigable portion of Salmon river. Removing obstructions from Grass and Racket rivers.

These works have been entered upon by the Superintendent of Public Works.

ORDINARY REPAIRS MADE DURING THE FISCAL YEAR — ERIE CANAL.

Aqueducts.

Port Byron.— Posts and planking on tow-path side, and twenty-eight floor-timbers were replaced.

Seneca river.— Four spans have been rewooded, and timber furnished for four more, which will complete the rewooding of this important structure and render any extensive repairs unnecessary for many years, unless it should be injured by accident.

Bridges.

The following superstructures have been rebuilt:

No. 6. John street, Utica, replaced under contract with iron lift-bridge. Tow-path bridge over Mohawk feeder on Whitesboro street, Rome.

No. 56. Swing over old Oneida Lake canal at Higginsville, on Oneida feeder. Bridges at Durhamville and Breeze street, Oneida.

No. 77. Bolivar road, replaced by tubular iron arch bridge, from Beach street, Syracuse.

No. 89. Breers (private) rebuilt with iron chords.

No. 90. Beach street, Syracuse, rebuilt under contract.

No. 103. West street, Syracuse, replaced under contract with iron lift-bridge.

No. 121. Hamilton street, Jordan. Bridge over Putnam brook feeder at Weedsport.

The following have received important repairs:

No. 2. Starch factory, Utica, replanked and painted.

No. 9. Hotel street, Utica, lift replanked.

No. 10. Seneca street, Utica, new sidewalks and railing reset.

No. 11. Washington street, Utica, new sidewalks and railing reset.

No. 24. Watkins street, Whitesboro, replanked and painted.

No. 28. River street, Oriskany, sidewalks relaid.

No. 34. Stanwix road, replanked.

No. 34½. Road-bridge on berme, new wooden abutments and general repairs.

No. 38. Washington street, Rome, sidewalks replanked.

No. 39. George street, Rome, replanked.

No. 40. Jay street, Rome, replanked.

No. 42. Doxtator avenue, Rome, replanked and painted.

No. 51. Grove Spring road, replanked.

No. 55. Happy Valley road, replanked.

No. 57. Higginsville east road, replanked.

No. 58. Higginsville west road, replanked.

No. 61. State road, replanked.

No. 66. Schoolhammer's road, replanked (canal part).

No. 86. Peterboro street, Canastota, replanked.

Bridge over feeder at Orville, rewooded.

No. 138. Hotaling's road, rewooded.

Other bridges have had general repairs.

Culverts.

Three-arch culvert, east of starch factory bridge, Utica.

A receiver dam has been built above culvert.

Composite culvert, east of Grove Spring road, thorough repairs.

First west of Nine-mile creek aqueduct has been cleaned out.

Dams and Bulkheads.

Oriskany feeder, thoroughly repaired.

Mohawk feeder, Rome, thoroughly repaired and new gate-house built.

Cowassalon creek feeder, Rome, thoroughly repaired and new rack built.

Limestone creek feeder, new apron, practically rewooded.

Locks.

Lock No. 46.—Pier has been repaired.

Lock No. 47.—Part of foundation concreted. Old masonry pointed.

Lock No. 48.—Old masonry pointed.

Lock No. 49.—New upper gates (four). Old masonry pointed.

Weight-lock, Syracuse.—Pier at east end rebuilt.

Lock No. 50.—Pier west end rebuilt.

Lock No. 52.—New iron rack, at head, and general repairs.

Waste-weirs.

On Limestone creek feeder.—General repairs.

On Camillus feeder.—Rebuilt and lowered to confirm with enlarged canal.

Vertical Wall, Rebuilt.

Seventy-five linear feet east of Burdick's bridge on the berme.

Seventy-five linear feet east of lock No. 47, on the berme.

Two hundred and seventy-five linear feet at Beech street bridge, Syracuse, rebuilt and set back under contract.

Miscellaneous.

Oneida creek feeder has been cleaned out.

Skaneateles creek feeder has had general repairs.

Canastota basin has been thoroughly cleaned out.

OSWEGO CANAL.

Bridges.

A new iron bridge (private) was built at the east end of Fulton dam.

The following bridges have been rebuilt:

Stringer bridge over Haskins' race, Salina.

Free street and Spring street, over north side cut, Salina.

First change bridge above lock No. 11.

Swing, over lock at Caughdenoy, Oneida river improvement.

The following have had important repairs:

James street, Willow street and Division street, Syracuse, replanked.

Greenpoint road and change, one roadway replanked and new guards.

Baldwinsville, Lock street, Phœnix, Seward street, Fulton and Minetto roads have been replanked.

Hubbard street, Oswego, has had new needlebeams, joists and plank.

Other bridges have had minor repairs.

Dams and Bulkheads.

Bulkhead at east end of Fulton dam was rebuilt.

Locks.

No. 6.—Two lower gates were rebuilt.

Guard-lock No. 4.—Two middle gates and two miter sills were rebuilt.

Lock No. 15.—Two lower gates were rebuilt.

Sluices (timber).

One sluice through tow-path rebuilt on river level below lock No. 5.

River Walls.

One hundred and fifty feet of wall below guard-lock No. 4. The original river wall at this point was the foundation to a private mill. It had become gradually disintegrated, and last spring split, one-half of it falling into the canal. A substantial wall was built in front (canal side) to a point one foot above water-surface of canal, making it perfectly secure.

Above lock No. 18, the river wall had become badly broken by the action of ice. It is now in course of thorough repair. These repairs will probably be finished before the close of navigation, but as the stone are small, it may be necessary to reinforce it with a wall of heavier stone on the river side to resist ice action. Such a wall should be carried fully above high-water mark.

Slope Wall.

Between lock No. 16 and guard-lock No. 5 the slope wall on river level has been repaired and put in good condition.

Brush has been cut on river slope wall between lock No. 7 and guard-lock No. 4.

CAYUGA AND SENECA CANAL.

Bridges.

Tow-path bridges have been rebuilt as follows:

One over White creek.

Two over factory flumes, Seneca Falls.

All between locks Nos. 7 and 8.

Two below lock No. 10 (Cayuga branch).

The following have been replanked:

Lake street, Geneva, south roadway.

Preëmption road, Geneva.

Ovid street, Seneca Falls, west roadway.

The two swing-bridges of the Fall Brook Coal Company, at Geneva, have been removed.

Dams.

Demont's, has been strengthened by loose stone (rip-rap).

Locks.

Lock No. 1. Two new balance beams.

Lock No. 4. Docking repaired.

Lock No. 6. Two new upper gates.

Lock No. 7. Two new lower gates, miter-sills and floor.

Lock No. 9. Two new upper gates.

Miscellaneous.

Light-house at Geneva has been repainted.

Castle creek receiver, Geneva, has been dredged out.

Other structures have had ordinary repairs.

BLACK RIVER CANAL.

Aqueducts.

All have had ordinary repairs, and all piers and abutments have been pointed.

Bridges.

Harrington, Wilcox, Adams, Westernville and Sugar river (three spans) have been rebuilt.

Also, tow-path bridges at locks Nos. 69, 94, 102, 107, and six not specified on section No. 2 have been rebuilt.

Castorland bridge, draw (iron), eighty-six feet long, turn-table and circle have been rebuilt.

Whitney's bridge has had new floor.

Tow-path bridges near locks Nos. 99, 105 and 108 have had new floors. Other have been generally repaired.

Culverts.

Outlets to Hall's, and arch No. 3 on Forestport feeder have been cleaned out twice.

Docking.

Three hundred lineal feet on tow-path above lock No. 1 has been rebuilt. The docking at the head of many of the locks has been repaired.

Dyke.

Between Delta dam and the guard-lock has been strengthened.

Locks.

Nos. 8 and 48 have been rebuilt under contract.

Nos. 1, 46, 59 and 60 have settled and the jaws were dressed off.

No. 8 has had three new gates.

Nos. 3, 23 and 30 have had two new gates.

Nos. 5, 10, 16, 31, 33, 34, 41, 48, 50, 59, 67 and 70 have had one new gate, also fourteen new gates (location not specified) have been put in on Section No. 2.

Otter creek lock on Black River improvement, has had one new gate.

Nos. 5, 22, 27, 29, 36, 37, 43, 44, 45, 51, 56, 57, 65, 69, 70, 71, 83, 85, 86, 91, 95 and 105 have had new miter-sills.

Nos. 27 and 47, new lock-houses have been built.

Nos. 13, 17, 22 and 24, lock-houses have been repaired.

Nos. 75, 77, 78, 79, 80, 85, 86 and 89, have been relined in whole or in part.

Nos. 94 and 100, have each had one new hollow quoin.

Nos. 75, 86, 88, 89, 90, 94, 97, 99, 100 and 101, sluices have been repaired.

Other locks have received general minor repairs.

Waste-weirs.

That at State dam at lock No. 33, and that at lock No. 48, have been repaired. New bulkheads and walks built and walls pointed.

Slope Wall.

Two hundred and fifty lineal feet along tow-path near lock No. 24, river side, and 100 lineal feet near Williams dock on Forestport feeder, have been built to strengthen the bank.

The tow-path has been raised and prism cleaned out generally.

ORDINARY REPAIRS NEEDED — ERIE CANAL.

Aqueducts.

Sauquoit, needs new sides.

Cowassalon, needs new sides and outside floor timbers.

Limestone, needs new floor plank and lining and perhaps new side plank.

Butternut, needs new floor plank and lining.

Jordan, needs general repairs.

Centerport, needs new floor plank and lining.

Port Byron, needs new side on berme.

Crane Brook, needs new floor plank and lining.

Seneca River, needs rewooding four spans (timber on hand).

Bridges.

No. 27. Christman's, farm is unsafe, should be rebuilt.

No. 82. Manlius Center road, should be rebuilt, (timber on hand).

No. 105. Genesee street, Geddes, is all right for ordinary traffic, but should have an additional roadway to accommodate the street railway. The abutments will have to be lengthened to do this.

No. 109. Gere's Landing road, should be rebuilt.

No. 123. Fountainville road, should be rebuilt.

No. 4. Broad street, Utica, needs new sidewalks, planking and general repairs.

No. 15. Breeze street, Utica, needs painting.

No. 16. Schuyler street, Utica, needs rewooding.

No. 21. Clinton street, Whitesboro, should have iron needle beams and wider sidewalk.

No. 25. Bradley road, should have iron needle beams.

No. 37. James street, Rome, needs replanking (this is to be done by the street railroad company).

No. 128. Seneca street, Weedsport, needs replanking.

No. 130. Brutus street, Weedsport, needs replanking.

No. 139, McLeods road, needs some new joists.

Culverts.

One at starch factory, Utica, masonry needs extensive repairs.

One near Clay street, Utica, north wings and parapet need relaying.

Four culverts, between Higginsville and Durhamville, tow-path wings need relaying.

Harbor brook, Geddes, retaining walls, tow-path side, should be rebuilt.

First, east of Putnam brook, coping and tow-path wings should be replaced.

First, east of Port Byron aqueduct, tow-path wings should be rebuilt.

Second, west of May's Point (last culvert on this division), tow-path wings should be rebuilt.

Feeders.

Oriskany should be improved, see general report under "navigation, etc."

Chittenango, bulkhead should be rebuilt.

Putnam brook, masonry and receiver should be rebuilt.

Port Byron, banks near dam at head need strengthening; pipe has some bad leaks, which grow worse year by year, should be repaired this season; coping on receiver, east wing, should be replaced.

Locks.

No. 46 needs two lower gates, berme lock.

No. 47 needs new wood-work for machinery (ordered).

No. 47 needs new hollow quoin, jambs and caps for tumble-gates.

No. 47 needs new pier at east end.

No. 48 needs new wood-work for machinery (ordered).

No. 48 needs new jambs, caps and tumble-gates, tow-path side.

No. 51, pier at head needs two new courses.

No. 51, two new balance beams needed.

Waste-weirs and bulkheads.

Ballou's, at Utica, needs new bulkhead and masonry pointed.

Tefft's, between Oriskany and Rome, needs new bulkhead, planking below spillway, and spillway relaid.

Fort Bull, near Rome, needs new bulkhead and spillway relaid.

Higginsville, masonry should be relaid and new bulkhead built.

Vertical wall.

On the berme, from east line of Oneida county to Ballou waste-weir, it is in very bad condition, as is the case at many other points in the city of Utica. Provision should be made for about one mile in all at this point.

At foot of lock fifty-one the new vertical wall on berme is undermined and settled. Should be rebuilt with sheet piling in front of foundation.

One hundred and twenty lineal feet east of Jordan feeder should be relaid.

Miscellaneous.

The gates should be taken out of old dry-dock at Grove Spring and the berme bank built across the opening.

The tumble-gate at entrance of new Oneida Lake canal should be taken out and tow-path bank built across the opening.

The bank (tow-path) west of Salt street bridge, Montezuma, should be loaded with brush and stone to prevent sliding.

OSWEGO CANAL.

Bridges.

Willow street, Syracuse, sidewalks need replanking.

Stringer bridge, at Haskins' mill, Salina, needs replanking.

Park street, over Oswego canal, needs replanking.

Park street, over south side-cut, needs replanking.

Bridge over discharge race from Mud creek spillway, needs replanking.

Greenpoint road, south roadway, needs replanking.

Road and change, near lock 5, needs new joists,

Over Onondaga outlet, needs replanking.

Cold Spring road, masonry needs pointing; bridge needs replanking.

Belgium road, masonry needs pointing; bridge needs replanking.

Broadway, Fulton, needs new sidewalks.

Oneida street, Fulton, should be rewooded entire, and iron needle-beams put in in place of wood.

Road and change, below lock 10, needs replanking.

Culverts.

Mud creek, Salina, needs new rack.

Bloody brook, Liverpool, needs cleaning out.

First north of Liverpool road bridge needs cleaning out.

The wooden box-culvert running alongside of lock No. 7, which gave so much trouble while the lock was being lengthened last winter, is in bad condition and should be replaced by a culvert running directly across the canal, above the lock. I would recommend a twenty-inch pipe for this work.

Dams and Bulkheads.

Bulkhead at east end of Oswego Falls dam should be rebuilt.

High dam at Oswego leaks badly; needs filling in upper side.

Oswego dam has a poor apron; should be replaced by a sloping apron of timber.

Locks.

Nos. 1, 2, 7 and 9 need two upper gates each.

No. 3 needs one upper gate.

Nos. 10, 13 and guard-lock 3 need two lower gates each.

Side-cut lock at Fulton needs two upper gates (provided for).

Upper end of sluice at lock No. 1 needs rebuilding.

No. 4 (north side-cut) needs lower miter-sill and bottom replanked.

Guard-lock 3 and lock 17 need new lock-houses.

Timber-lock on Baldwinsville side-cut needs four gates and four new quoins; sides should be taken down four courses and relaid.

Piers

at outlet of Onondaga lake are so far decayed that they are little more than banks of rip-rap; should be rebuilt.

Sluices (timber).

Ten need rebuilding on river level, between lock No. 5 and Three-River Point.

Spillways

Spillway below lock No. 8 should be rebuilt.

State Shop

at Fulton needs reshingling.

The mill on berme, between guard-lock 5 and lock 17, owned by Penfield & Johnson, was burned during the summer. The division wall between mill-pit and canal is very weak, and should be rebuilt, without fail, before opening of canal in the spring, and made heavier.

The brush along the tow-path on the river levels has grown so high as to seriously interfere with navigation. It has been cut between lock 7 and guard-lock No. 3; should be cut on all the other river levels.

CAYUGA AND SENECA CANAL.

Bridges.

Swing, over lock No. 10 (Cayuga), track needs leveling.

Tow-path bridge, near Geneva and Lyons railroad, needs rebuilding.

Lake street, Geneva, north roadway, needs replanking.

Locks.

No. 2 needs two lower gates and repairs to bottom.

No. 3 needs two lower gates.

No. 6 bottom needs repairs. Will have to be pumped.

No. 8 needs four new gates. Should be pumped and relined.

No. 11 needs two new balance-beams.

Piers.

At Geneva, all need new top-sticks.

Waste-weir.

Between locks No. 5 and 6, needs new bulkhead (provided for).

Piles and fenders should be driven at the sharp bend at the junction of canal, round the foot of Seneca lake and the outlet. The curve is so sharp that boats must hug the shore, and without the fenders are almost sure to get aground.

BLACK RIVER CANAL.

Aqueducts.

Lansing Kill and Sugar river trunks should be rebuilt.

Bridges.

New abutments should be built under the David Jones and Carpenter bridges.

Whittlesey's and Beach's, over Black river improvement, should have new swings or the old ones extensively repaired.

Illingworth's needs replanking.

Two more iron spans should be built at the Castorland bridge, making it an entire iron bridge.

Dams.

On second Bisby and the "Old Forge" dam need repairs.

Locks.

Nos. 1, 46, 59 and 60 have settled continually and need cutting off every year to enable boats to pass.

Nos. 12, 37 and 55 have also given much trouble, mainly from the face of stone breaking off and projecting into the chamber. All these locks should be rebuilt. (No. 60 is to be let this fall.)

Nos. 8, 92 and 93 should be relined.

No. 76 needs thorough repairs.

Ten new miter-sills and ten new gates are needed on section No. 2. (Location not specified.)

The other locks which have not been pointed, should be next spring.

ENGINEERING.

This division has been under the charge of Denison Richmond as division engineer, and Henry T. Beach as resident engineer, during the fiscal year.

The extraordinary work has been so scattered as to require a seemingly large force of assistants, and has caused a large expense for travel, which, however, has been kept as low as was consistent with the proper performance of the work.

Considerable time has been spent in making surveys and maps, and collecting data for the Board of Claims, which has been done under the special appropriation for the purpose. A further appropriation should be made for this class of work for the coming year.

Maps, plans and specifications have been made for most of the new work, and others are in course of preparation.

Work done under ordinary repairs has been promptly attended to.

I attach table No. 1 showing distribution of engineering expenses, No. 2 showing status of construction work under special appropriations, and No. 3 giving the water record of Cayuga and Cross lakes and Seneca river, as per concurrent resolution of 1884.

This record does not accomplish the desired object, if I understand it correctly. The dates of measurements are fixed by the resolution, and do not show either highest or lowest water, nor do the results afford any comparison between the original and present condition of the lakes and river. If it is desirable to continue these measurements, self-registering gauges should be set at the specified points, which would give a complete record of the fluctuations of the water.

The comparative condition can not be obtained, as no records exist of the state of lakes and river channel before the attempted improvement of the river channel. I doubt if any good result will follow the continuance of these measurements.

All of which is respectfully submitted.

H. T. BEACH,
Acting Division Engineer.

NOTE. November sixteenth. Through the sudden and unexpected death of Mr. Richmond, a few days after the close of the fiscal year, the duty of writing his report devolved on me. I have endeavored to incorporate his views in the report, but as we had had no special consultation in the matter, I have been compelled to follow my own ideas in the main. I think they are in practical agreement with his.

H. T. BEACH.

TABLE No. 1.

Statement showing the names, rank and compensation of engineers employed on the middle division of the New York State canals, together with the incidental expenses for the fiscal year ending September 30, 1888.

ORDINARY REPAIRS — ERIE CANAL.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Denison Richmond	Division engineer	Salary			$2,400	$1,117 46
Denison Richmond	Division engineer	Travel				141 61
H. T. Beach	Resident engineer	Salary			2,000	551 86
H. T. Beach	Resident engineer	Travel				42 25
David E. Whitford	Assistant engineer in charge	Salary	38	$6 00		228 00
David E. Whitford	Assistant engineer in charge	Travel				25 35
Chas. G. Witbeck	Assistant engineer in charge	Salary	14	6 00		84 00
Chas. G. Witbeck	Assistant engineer in charge	Travel				18 64
R. R. Stuart	Leveler	Salary	93	4 50		418 50
R. R. Stuart	Leveler	Travel				77 28
Arthur V. Meeker	Leveler	Salary	235	4 50		1,057 50
Arthur V. Meeker	Leveler	Travel				15 62
E. D. Breed	Leveler	Salary	55	4 50		247 50
E. D. Breed	Leveler	Travel				60 74
Ambrose C. Driscoll	Rodman	Salary	7	3 50		24 50
S. L. Way	Rodman	Salary	10	3 50		35 00
S. L. Way	Rodman	Travel				8 36
T. V. Owens	Chainman	Salary	62	2 50		155 00
T. V. Owens	Chainman	Travel				63 21
Henry Blum	Chainman	Salary	7	2 50		17 50
Henry Blum	Chainman	Travel				2 31
						$4,392 19
Incidental expenses.						
Stationery					$283 26	
Fuel and light					63 30	
Postage and telegraph					113 75	
Miscellaneous					543 08	
						1,003 39
						$5,395 58

TABLE NO. 1 — *Statement of engineering expenses* — (Continued).

ORDINARY REPAIRS — OSWEGO CANAL.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Denison Richmond	Division engineer	Salary			$2,400 00	$550 00
Denison Richmond	Division engineer	Travel				83 16
H. T. Beach	Resident engineer	Salary			2,000 00	650 00
H. T. Beach	Resident engineer	Travel				203 06
Charles G. Whitbeck	Assistant engineer in charge	Salary	27	$6 00		162 00
Charles G. Whitbeck	Assistant engineer in charge	Travel				71 24
R. R. Stuart	Leveler	Salary	22	4 50		99 00
R. R. Stuart	Leveler	Travel				49 81
F. M. Thomas	Leveler	Salary	16	4 50		72 00
F. M. Thomas	Leveler	Travel				10 50
Theodore A. Hendrickson	Rodman	Salary	21	3 50		73 50
Theodore A. Hendrickson	Rodman	Travel				27 00
S. L. Way	Rodman	Salary	5	3 50		17 50
S. L. Way	Rodman	Travel				1 45
Frank D. Lamouree	Rodman	Salary	7	3 50		24 50
Frank D. Lamouree	Rodman	Travel				7 05
Henry Blum	Chainman	Salary	26	2 50		65 00
Henry Blum	Chainman	Travel				9 40
John H. Costigan	Chainman	Salary	16	2 50		40 00
John H. Costigan	Chainman	Travel				12 10
Dennis Sullivan	Chainman	Salary	26	2 50		65 00
Dennis Sullivan	Chainman	Travel				11 65
						$2,304 92
	Incidental expenses.					
Miscellaneous						48 00
						$2,352 92

TABLE No. 1 — *Statement of engineering expenses* — (Continued).

ORDINARY REPAIRS — CAYUGA AND SENECA CANAL.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Denison Richmond	Division engineer	Salary			$2,400	$169 08
Denison Richmond	Division engineer	Travel				21 98
H. T. Beach	Resident engineer	Salary			2,000	21 30
H. T. Beach	Resident engineer	Travel				6 56
R. R. Stuart	Leveler	Salary	2	$4 50		9 00
R. R. Stuart	Leveler	Travel				4 32
Total for Cayuga and Seneca canals						$232 24

BLACK RIVER CANAL.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Denison Richmond	Division engineer	Salary			$2,400	$375 00
Denison Richmond	Division engineer	Travel				82 39
H. T. Beach	Resident engineer	Salary			2,000	256 10
H. T. Beach	Resident engineer	Travel				36 94
David E. Whitford	Assistant engineer in charge	Salary	30	$6 00		180 00
David E. Whitford	Assistant engineer in charge	Travel				66 06
C. E. Phelps	Surveyor	Salary	59	5 00		295 00
C. E. Phelps	Surveyor	Travel				282 83
E. D. Breed	Leveler	Salary	105	4 50		472 50
E. D. Breed	Leveler	Travel				220 51
R. R. Stuart	Leveler	Salary	17	4 50		76 50
R. R. Stuart	Leveler	Travel				27 32
F. N. Phelps	Leveler	Salary	26	4 50		117 00
Frank D. Lamouree	Rodman	Salary	147	3 50		514 50
Frank D. Lamouree	Rodman	Travel				85 59
Ambrose C. Driscoll	Rodman	Salary	83	3 50		290 50
Ambrose C. Driscoll	Rodman	Travel				15 09
L. L. Way	Rodman	Salary	5	3 50		17 50
L. L. Way	Rodman	Travel				9 66
T. V. Owens	Chainman	Salary	115	2 50		287 50
T. V. Owens	Chainman	Travel				116 73
Henry Blum	Chainman	Salary	1	2 50		2 50
Henry Blum	Chainman	Travel				3 06
F. C. Phelps	Chainman	Salary	26	2 50		65 00
E. B. Herrington	Chainman	Salary	31	2 50		77 50

TABLE No. 1 — *Statement of engineering expenses* — (Continued).

ORDINARY REPAIRS — BLACK RIVER CANAL — (*Continued*).

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
F. S. Fanning	Chainman	Salary	31	$2 50	....	$77 50
R. M. Jones	Axman	Salary	26	2 00	....	52 00
I. C. Dunbar	Axman	Salary	29	2 00	....	58 00
George Phillips	Flagman	Salary	26	2 00	....	52 00
Total for Black River canal						$4,212 78

CHEMUNG CANAL.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Denison Richmond	Division engineer	Salary	....	....	$2,400 00	$50 00
Denison Richmond	Division engineer	Travel	....	....	....	7 08
H. T. Beach	Resident engineer	Salary	....	....	....	5 43
Total for Chemung canal						$62 51

SUMMARY.

Erie canal	$5,395 58
Oswego canal	2,352 92
Cayuga and Seneca canal	232 24
Black River canal	4,212 78
Chemung canal	62 51
Total engineering ordinary repairs	$12,256 03

WIDENING THE ERIE CANAL, ETC., NEAR LOCK 47, AT BEECH STREET, SYRACUSE.

Chap. 646, *Laws of* 1886.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Total Amount.
David E. Whitford	Assistant engineer in charge	Salary	43	$6 00	....	$258 00
David E. Whitford	Assistant engineer in charge	Travel	....	....	....	4 65
R. R. Stuart	Leveler	Salary	66	4 50	....	297 00
R. R. Stuart	Leveler	Travel	....	....	....	17 78
Henry Blum	Chainman	Salary	18	2 50	....	45 00
Henry Blum	Chainman	Travel	....	....	....	1 75
Total						$624 18

EXTRAORDINARY REPAIRS — ERIE CANAL.

Lengthening locks — Chap. 113, *Laws of* 1887.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	32	$6 00		$192 00
David E. Whitford	Assistant engineer in charge	Travel				25 00
Ellis B. Noyes	Assistant engineer in charge	Salary	108	6 00		648 00
Ellis B. Noyes	Assistant engineer in charge	Travel				78 56
Arthur V. Meeker	Leveler	Salary	78	4 50		351 00
Arthur V. Meeker	Leveler	Travel				24 69
E. D. Breed	Leveler	Salary	15	4 50		67 50
E. D. Breed	Leveler	Travel				25 21
Ambrose C. Driscoll	Rodman	Salary	132	3 50		462 00
Ambrose C. Driscoll	Rodman	Travel				16 37
Theo. A. Hendrickson	Rodman	Salary	2	3 50		7 00
Theo. A. Hendrickson	Rodman	Travel				8 86
S. L. Way	Rodman	Salary	139	3 50		486 50
S. L. Way	Rodman	Travel				42 45
T. V. Owens	Chainman	Salary	8	2 50		20 00
T. V. Owens	Chainman	Travel				16 93
Henry Blum	Chainman	Salary	29	2 50		72 50
Henry Blum	Chainman	Travel				5 16
Dennis Sullivan	Chainman	Salary	14	2 50		35 00
Dennis Sullivan	Chainman	Travel				17 72
						$2,602 45
	Incidental expenses.					
Fuel and light					$21 05	
Miscellaneous					213 25	
						234 30
Total						$2,836 75

Lift bridge at John street, Utica, Chap. 274, *Laws of* 1887.

George P. Hilton, preparing plans	$108 00

LIFT-BRIDGE AT WEST STREET, SYRACUSE.

Chapter 233, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	24	$6 00		$144 00
E. D. Breed	Leveler	Salary	27	4 50		121 50
A. C. Driscoll	Rodman	Salary	8	3 50		28 00
T. V. Owens	Chainman	Salary	10	2 50		25 00
Total						$318 50

SURVEY FOR DRAINING OLD CANAL AT ROME.

Chapter 371, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	6	$6 00		$36 00
David E. Whitford	Assistant engineer in charge	Travel				2 06
Charles G. Whitbeck	Assistant engineer in charge	Salary	4	6 00		24 00
Charles G. Whitbeck	Assistant engineer in charge	Travel				5 44
E. D. Breed	Leveler	Salary	5	4 50		22 50
E. D. Breed	Leveler	Travel				7 37
Theo. A. Hendrickson	Rodman	Salary	10	3 50		35 00
Theo. A. Hendrickson	Rodman	Travel				16 68
S. L. Way	Rodman	Salary	1	3 50		3 50
S. L. Way	Rodman	Travel				2 56
John H. Costigan	Chainman	Salary	2	2 50		5 00
John H. Costigan	Chainman	Travel				1 56
Henry Blum	Chainman	Salary	4	2 50		10 00
Henry Blum	Chainman	Travel				7 17
						$178 84
	Incidental expenses.					
Miscellaneous						7 50
Total						$186 34

EXTRAORDINARY REPAIRS — SURVEY OF THE JORDAN LEVEL.

Deepening the Erie canal — *Chap.* 416, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	9	$6 00	....	$54 00
David E. Whitford	Assistant engineer in charge	Travel	....	....	....	14 32
R. R. Stuart	Leveler	Salary	24	4 50	....	108 00
R. R. Stuart	Leveler	Travel	....	....	....	14 88
S. L. Way	Rodman	Salary	12	3 50	....	42 00
S. L. Way	Rodman	Travel	....	....	....	10 22
Ambrose C. Driscoll	Rodman	Salary	10	3 50	....	35 00
Ambrose C. Driscoll	Rodman	Travel	....	....	....	16 23
T. V. Owens	Chainman	Salary	43	2 50	....	107 50
T. V. Owens	Chainman	Travel	....	....	....	18 39
						$420 54
Incidental Expenses.						
Miscellaneous						68 55
Total						$489 09

Extraordinary Repairs — Oswego Canal.

Lengthening locks — Chap. 113 *Laws of* 1887.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
H. T. Beach	Resident engineer	Salary			$2,000 00	$333 34
H. T. Beach	Resident engineer	Travel				49 65
Charles G. Whitbeck	Assistant engineer in charge	Salary	189	$6 00		1,134 00
Charles G. Whitbeck	Assistant engineer in charge	Travel				456 14
F. M. Thomas	Leveler	Salary	188	4 50		846 00
F. M. Thomas	Leveler	Travel				10 35
R. R. Stuart	Leveler	Salary	67	4 50		301 50
R. R. Stuart	Leveler	Travel				49 15
Theo. A. Hendrickson	Rodman	Salary	189	3 50		661 50
Thomas A. Hendrickson	Rodman	Travel				68 15
Henry Blum	Chainman	Salary	32	2 50		80 00
Henry Blum	Chainman	Travel				18 36
John H. Costigan	Chainman	Salary	178	2 50		445 00
John H. Costigan	Chainman	Travel				64 62
Charles R. Reed	Chainman	Salary	195	2 50		487 50
Charles R. Reed	Chainman	Travel				65 55
Dennis Sullivan	Chainman	Salary	109	2 50		272 50
Dennis Sullivan	Chainman	Travel				8 00
						$5,351 31
	Incidental Expenses.					
Stationery					$16 00	
Postage and telegraph					21 50	
Miscellaneous					46 72	
						84 22
Total for Oswego canal						$5,435 53

EXTRAORDINARY REPAIRS — OSWEGO CANAL.

Dredging the Liverpool level — Chapter 113, *Laws of* 1887.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Charles G. Witbeck	Assistant engineer in charge	Salary	25	$6 00		$150 00
Charles G. Witbeck	Assistant engineer in charge	Travel				84 77
F. M. Thomas	Leveler	Salary	25	4 50		112 50
F. M. Thomas	Leveler	Travel				22 72
F. D. Lamouree	Rodman	Salary	47	3 50		164 50
F. D. Lamouree	Rodman	Travel				28 76
A. C. Driscoll	Rodman	Salary	2	3 50		7 00
A. C. Driscoll	Rodman	Travel				95
Theodore A. Hendrickson	Rodman	Salary	28	3 50		98 00
Theodore A. Hendrickson	Rodman	Travel				34 30
J. H. Costigan	Chainman	Salary	25	2 50		62 50
J. H. Costigan	Chainman	Travel				22 20
D. Sullivan	Chainman	Salary	8	2 50		20 00
D. Sullivan	Chainman	Travel				2 75
Henry Blum	Chainman	Salary	67	2 50		167 50
Henry Blum	Chainman	Travel				24 45
T. V. Owens	Chainman	Salary	2	2 50		5 00
T. V. Owens	Chainman	Travel				90
Total for Liverpool level						$1,008 80

EXTRAORDINARY REPAIRS — OSWEGO CANAL.

Lengthening locks — Chapter 416, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Charles G. Whitbeck	Assistant engineer in charge	Salary	46	$6 00	....	$276 00
Charles G. Whitbeck	Assistant engineer in charge	Travel	....	....	....	22 29
F. M. Thomas	Leveler	Salary	65	4 50	....	292 50
F. M. Thomas	Leveler	Travel	....	....	....	75
R. R. Stuart	Leveler	Salary	2	4 50	....	9 00
R. R. Stuart	Leveler	Travel	....	....	....	5 50
Theodore A. Hendrickson	Rodman	Salary	50	3 50	....	175 00
Theodore A. Hendrickson	Rodman	Travel	....	....	....	16 15
A. C. Driscoll	Rodman	Salary	2	3 50	....	7 00
A. C. Driscoll	Rodman	Travel	....	....	....	1 50
S. L. Way	Rodman	Salary	22	3 50	....	77 00
S. L. Way	Rodman	Travel	....	....	....	7 36
Henry Blum	Chainman	Salary	10	2 50	....	25 00
Henry Blum	Chainman	Travel	....	....	....	....
Charles R. Breed	Chainman	Salary	30	2 50	....	75 00
Charles R. Breed	Chainman	Travel	....	....	....	9 25
John H. Costigan	Chainman	Salary	42	2 50	....	105 00
John H. Costigan	Chainman	Travel	....	....	....	2 50
Total for Oswego canal						$1,106 80

CAYUGA AND SENECA CANAL.

Removing obstructions and improving locks — Chap. 113, *Laws of* 1887.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	6	$6 00	....	$36 00
David E. Whitford	Assistant engineer in charge	Travel	....	....	....	6 94
E. D. Breed	Leveler	Salary	2	4 50	....	9 00
E. D. Breed	Leveler	Travel	....	....	....	4 90
T. V. Owens	Chainman	Salary	3	2 50	....	7 50
T. V. Owens	Chainman	Travel	....	....	....	7 30
Total						$71 64

CHEMUNG CANAL.

Basin at Havana and opening the lake level — Chap. 416, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	10	$6 00	....	$60 00
David E. Whitford	Assistant engineer in charge	Travel	....	....	....	12 49
R. R. Stuart	Leveler	Salary	4	4 50	....	18 00
R. R. Stuart	Leveler	Travel	....	....	....	8 89
A. C. Driscoll	Rodman	Salary	6	3 50	....	21 00
A. C. Driscoll	Rodman	Travel	....	....	....	12 10
S. L. Way	Rodman	Salary	4	3 50	....	14 00
S. L. Way	Rodman	Travel	....	....	....	8 39
T. V. Owens	Chainman	Salary	4	2 50	....	10 00
T. V. Owens	Chainman	Travel	....	....	....	6 99
Total						$171 86

EXTRAORDINARY REPAIRS.

Dredging the outlet of Crooked lake—*Chap.* 234, *Laws of* 1887.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	57	$6 00	....	$342 00
David E. Whitford	Assistant engineer in charge	Travel	....	....	....	46 33
E. D. Breed	Leveler	Salary	9	4 50	....	40 50
E. D. Breed	Leveler	Travel	....	....	....	10 96
R. R. Stuart	Leveler	Salary	6	4 50	....	27 00
R. R. Stuart	Leveler	Travel	....	....	....	19 03
F. M. Thomas	Leveler	Salary	3	4 50	....	13 50
F. M. Thomas	Leveler	Travel	....	....	....	6 48
S. L. Way	Rodman	Salary	5	3 50	....	17 50
S. L. Way	Rodman	Travel	....	....	....	13 35
T. V. Owens	Chainman	Salary	55	2 50	....	137 50
T. V. Owens	Chainman	Travel	....	....	....	64 63
Henry Blum	Chainman	Salary	17	2 50	....	42 50
Henry Blum	Chainman	Travel	....	....	....	12 96
Total under chapter 234, Laws of 1887						$794 24

EXTRAORDINARY REPAIRS — CROOKED LAKE OUTLET.

Chapter 206, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	54	$6 00	....	$324 00
David E. Whitford	Assistant engineer in charge	Travel	....	....	....	76 20
E. D. Breed	Leveler	Salary	38	4 50	....	171 00
E. D. Breed	Leveler	Travel	....	....	....	38 69
A. C. Driscoll	Rodman	Salary	15	3 50	....	52 50
A. C. Driscoll	Rodman	Travel	....	....	....	5 98
T. V. Owens	Chainman	Salary	14	2 50	....	35 00
T. V. Owens	Chainman	Travel	....	....	....	16 60
						$719 97

EXTRAORDINARY REPAIRS — IMPROVING THE HARBOR OF CANANDAIGUA LAKE.

Chapter 192, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
David E. Whitford	Assistant engineer in charge	Salary	7	$6 00	....	$42 00
David E. Whitford	Assistant engineer in charge	Travel	....	....	....	10 06
E. D. Breed	Leveler	Salary	14	4 50	....	63 00
E. D. Breed	Leveler	Travel	....	....	....	14 25
S. L. Way	Rodman	Salary	3	3 50	....	10 50
S. L. Way	Rodman	Travel	....	....	....	9 86
Henry Blum	Chainman	Salary	3	2 50	....	7 50
Henry Blum	Chainman	Travel	....	....	....	8 23
Total						$165 40

EXTRAORDINARY REPAIRS — BEAVER RIVER RESERVOIR.

Chap. 330, *Laws of* 1886.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
C. E. Phelps	Surveyor	Salary	28	$5 00	....	$140 00
C. E. Phelps	Surveyor	Travel	....	....	....	55 50
F. N. Phelps	Leveler	Salary	26	4 50	....	117 00
F. N. Phelps	Leveler	Travel	....	....	....	19 50
F. C. Phelps	Chainman	Salary	26	2 50	....	65 00
F. C. Phelps	Chainman	Travel	....	....	....	19 50
F. S. Fanning	Chainman	Salary	26	2 50	....	65 00
F. S. Fanning	Chainman	Travel	....	....	....	19 50
E. B. Harrington	Chainman	Salary	26	2 50	....	65 00
E. B. Harrington	Chainman	Travel	....	....	....	19 50
R. M. Jones	Axman	Salary	26	2 00	....	52 00
R. M. Jones	Axman	Travel	....	....	....	19 50
J. C. Dunbar	Axman	Salary	26	2 00	....	52 00
J. C. Dunbar	Axman	Travel	....	....	....	19 50
George Phillips	Flagman	Salary	26	2 00	....	52 00
George Phillips	Flagman	Travel	....	....	....	19 50
Total						$800 00

SURVEYS FOR STATE BOARD OF CLAIMS — ERIE CANAL.

Chapter 249, *Laws of* 1888.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
Denison Richmond	Division engineer	Salary			$2,400 00	$138 46
Denison Richmond	Division engineer	Travel				17 46
H. T. Beach	Resident engineer	Salary			2,000 00	83 33
H. T. Beach	Resident engineer	Travel				14 22
Charles G. Witbeck	Assistant engineer in charge	Salary	14	$6 00		84 00
Charles G. Witbeck	Assistant engineer in charge	Travel				43 06
R. R. Stuart	Leveler	Salary	12	4 50		54 00
R. R. Stuart	Leveler	Travel				12 78
F. M. Thomas	Leveler	Salary	14	4 50		63 00
F. M. Thomas	Leveler	Travel				7 58
Theodore A. Hendrickson	Rodman	Salary	17	3 50		59 50
Theodore A. Hendrickson	Rodman	Travel				9 76
Henry Blum	Chainman	Salary	9	2 50		22 50
Henry Blum	Chainman	Travel				7 33
M. J. Rosa	Chainman	Salary	14	2 50		35 00
M. J. Rosa	Chainman	Travel				4 72
M. F. Wemple	Chainman	Salary	7	2 50		17 50
M. F. Wemple	Chainman	Travel				2 72
						$676 91
	Incidental expenses.					
Stationery						14 02
Total						$690 93

OSWEGO CANAL.

NAMES.	Rank.	Salary or travel.	Number of days.	Rate per day.	Rate per year.	Amount.
H. T. Beach	Resident engineer	Salary			$2,000	$98 64
H. T. Beach	Resident engineer	Travel				10 82
Chas. G. Witbeck	Assistant engineer in charge	Salary	4	$6 00		24 00
Chas. G. Witbeck	Assistant engineer in charge	Travel				7 03
F. M. Thomas	Leveler	Salary	12	4 50		54 00
F. M. Thomas	Leveler	Travel				9 71
Theo. A. Hendrickson	Rodman	Salary	11	3 50		38 50
Theo. A. Hendrickson	Rodman	Travel				12 70
A. C. Driscoll	Rodman	Salary	1	3 50		3 50
A. C. Driscoll	Rodman	Travel				2 80

Henry Blum	Chainman	Salary	7	2 50	....	17 50
Henry Blum	Chainman	Travel	....	....	....	2 75
M. J. Rosa	Chainman	Salary	5	2 50	....	12 50
M. J. Rosa	Chainman	Travel	....	....	....	4 00
						$298 45

Incidental expenses.

Miscellaneous	28 00
Total	$326 45

CHEMUNG CANAL.

Chas. G. Witbeck	Assistant engineer in charge	Salary	11	$6 00	....	$66 00
Chas. G. Witbeck	Assistant engineer in charge	Travel	....	....	....	32 12
F. M. Thomas	Leveler	Salary	3	4 50	....	13 50
F. M. Thomas	Leveler	Travel	....	....	....	16 24
Theo. A. Hendrickson	Rodman	Salary	3	3 50	....	10 50
Theo. A. Hendrickson	Rodman	Travel	....	....	....	16 24
M. J. Rosa	Chainman	Salary	2	2 50	....	5 00
M. J. Rosa	Chainman	Travel	....	....	....	9 12
M. F. Wemple	Chainman	Salary	2	2 50	....	5 00
M. F. Wemple	Chainman	Travel	....	....	....	9 12
Total						$182 84

TABLE No. 2.

Statement of work under contract upon the middle division of the New York State canals, for the fiscal year ending September 30, 1888.

ERIE CANAL.

CHARACTER OF WORK.	AUTHORIZED BY		Appropriation.	When let.	When to be completed.
	Chapter	Laws of			
Lengthening of berme lock No. 46	113	1887	Part of $375,000	June 28, 1887	April 1, 1888
Constructing lift-bridge, John street Utica	274	1887	9,000	Contract, Nov. 15, 1887.	Jan. 15, 1888
Constructing lift-bridge, West street, Syracuse	233	1887	13,000	Contract, March 5, 1887.	May 1, 1888
Draining the old Erie canal at Rome	371	1888	8,500	July 3, 1888	Dec. 1, 1888
Constructing vertical wall between St. James st. and Black River canal	372	1888	5,000	July 3, 1888	Oct. 15, 1888
Beach street bridge abutments and vertical wall, Syracuse	646	1886	....	Contract, Feb. 11, 1888.	April 1, 1888
OSWEGO CANAL.					
Lengthening lock No. 7	113	1887	$50,000	August 2, 1887	April 1, 1888
Lengthening guard-lock No. 4	113	1887		August 2, 1887	April 1, 1888
Dredging the Liverpool level	113	1887	10,000	September 20, 1887	April 1, 1888
Lengthening guard-lock No. 3	416	1888	60,000	August 8, 1888	April 15, 1889
Lengthening lock No. 11	416	1888		August 8, 1888	April 15, 1889
BLACK RIVER CANAL.					
Rebuilding lock 8	113	1887	$15,000	August 23, 1887	April 1, 1888
Rebuilding lock 48	113	1887		August 23, 1887	April 1, 1888
Vertical wall along Lock street, Rome	270	1888	1,200	July 3, 1888	Oct. 15, 1888
CROOKED LAKE OUTLET.					
Dredging the outlet of Crooked lake	234	1887	$20,000	June 24, 1887	April 1, 1888
Dredging the outlet of Crooked lake	206	1888	15,000	Contract, May 25, 1888.	Aug. 1, 1888
CANANDAIGUA LAKE.					
Deepening harbor and constructing breakwater	192	1888	$15,000	August 27, 1888	....

TABLE No. 2 — *Statement of work under contract upon the middle division, etc.*— (Continued).

CHARACTER OF WORK.	Engineer's estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Remarks.
ERIE CANAL.					
Lengthening of berme lock No. 46	$18,500	$15,117 50	$2,805 00	$2,805 00	Stopped by injunction.
Constructing lift-bridge, John street, Utica	....	9,000 00	*9,000 00	*9,000 00	Final rendered.
Constructing lift-bridge, West street, Syracuse	13,000	12,314 90	11,966 13	11,966 13	Final rendered.
Draining the old Erie canal at Rome	....	7,215 60	....	....	Stopped by injunction.
Constructing vertical wall between St. James street and Black River canal	4,500	2,986 50	527 00	527 00	In progress.
Beach street bridge abutments and vertical wall, Syracuse	4,200	3,580 25	3,626 84	3,626 84	Final rendered.
OSWEGO CANAL.					
Lengthening lock No. 7	$29,000	$22,930 50	$21,086 68	$21,086 68	Final rendered.
Lengthening guard-lock No. 4	20,000	14,977 50	13,696 16	13,696 16	Final rendered.
Dredging the Liverpool level	10,000	7,385 00	7,026 32	7,026 32	Final rendered.
Lengthening guard-lock No. 3	21,500	19,836 25	1,275 00	1,275 00	In progress.
Lengthening lock No. 11	38,500	32,724 25	....	....	In progress.
BLACK RIVER CANAL.					
Rebuilding lock 8	$7,107	$10,387 00	*$9,355 65	*$9,355 65	Final rendered.
Rebuilding lock 48	6,972	9,774 00	9,274 50	9,274 50	Final rendered.
Vertical wall along Lock street, Rome	1,200	1,046 00	....	....	In progress.
CROOKED LAKE OUTLET.					
Dredging the outlet of Crooked lake	$20,000	$17,680 00	$15,028 00	$15,028 00	Completed; final not rendered.
Dredging the outlet of Crooked lake	13,000	11,550 00	9,350 00	9,350 00	Completed; final not rendered.
CANANDAIGUA LAKE.					
Deepening harbor and constructing breakwater	$15,000	$14,135 00	....	....	No work done September 30.

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* A portion of this work was paid for from other funds, which does not show in this table.

TABLE No. 3.

Water record of Cayuga and Cross lakes and Seneca river, as per concurrent resolution of 1884.

Water surface given below datum line.

LOCATION.	Bench-mark number.	Miles from Cayuga lock.	1884.				1885.						1886.					
			AUGUST 5, 6 AND 7.		DECEMBER 2, 3 AND 4.		MARCH 4, 5, 6 AND 7.		AUGUST 6 AND 7.		DECEMBER 2, 3 AND 4.		MARCH 8 AND 9.		AUGUST 5, 6 AND 7.		DECEMBER 7.	
			WATER.		WATER.		WATER.		WATER.		WATER.		WATER.		WATER.		WATER.	
			Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.
Cayuga lake...........	1	......	— 8.59	10.49	—10.11	8.79	—10.00	9.08	— 9.33	9.75	— 8.78	10.30	— 8.11	10.97	— 8.49	10.59	— 8.33	10.75
Mud lock	2	1½	— 8.80	10.42	—10.22	9.00	—10.17	9.05	— 9.54	9.68	— 8.91	10.31	— 8.26	10.96	— 8.76	10.46	— 8.46	10.76
Canandaigua river, south of Erie canal..	....	6½	—11.20	5.60	—12.86	4.00	—12.54	4.60	—11.93	5.20	—11.04	6.10	— 9.61	7.60	—11.88	5.40	—10.20	7.00
Erie canal aqueduct..	3	6½	—11.42	7.03	—12.98	5.47	—12.66	5.70	—12.19	6.20	—11.26	7.10	— 9.72	8.70	—12.12	6.30	—10.35	8.10
Canandaigua river, north of Erie canal..	....	6½	—11.58	5.40	—13.01	4.00	—12.83	4.90	—12.48	5.20	—11.48	6.20	— 9.93	7.80	—12.24	5.40	—10.59	7.10
W. S. R. R. crossing...	4	9	—11.85	3.75	—13.20	2.40	—12.70	2.80	—12.87	2.60	—11.84	3.60	—10.24	5.20	—12.76	2.70	—10.79	4.50
			......	7.80	......	6.50	......	7.70	......	7.50	......	8.50	......	10.50	......	7.60	......	9.40
N.Y.C. & H.R.R.cross'g	5	10	—12.41	4.80	—14.19	3.00	—13.48	3.90	—13.48	3.90	—12.66	4.70	—10.74	6.60	—13.31	4.00	—11.61	5.70
Mosquito Point	6	15¼	—15.92	0.10	—16.81	*	—16.70	*	—16.04	*	—14.23	1.80	—12.15	4.00	—16.26	*	—13.39	2.60
			......	7.20	......	6.30	......	6.40	......	7.10	......	8.90	......	11.00	......	7.00	......	9.70
Cross lake	7	25	—17.32	19.20	—17.55	19.00	—18.00	18.50	—17.85	18.70	—15.38	21.10	—14.01	22.50	—17.71	18.80	—15.39	21.10

* Bed dry.

TABLE No. 3 — *Water record of Cayuga and Cross lakes and Seneca river, etc.* — (Continued).

LOCATION.	1887.						1888.				Remarks.
	MARCH 4.		AUGUST 5.		DECEMBER 2.		MARCH 2.		AUGUST 6.		
	WATER.		WATER.		WATER.		WATER.		WATER.		
	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	
Cayuga lake	— 6.69	12.39	— 8.22	10.86	— 9.75	9.33	— 9.00	10.08	— 8.88	10.20	Depth on lock miter-sill.
Mud lock	— 6.82	12.40	— 8.35	10.87	— 9.97	9.25	— 9.11	10.11	— 9.09	10.13	Depth on miter-sill.
Canandaigua river south of Erie canal	— 7.89	9.30	—10.87	6.30	......	.....	—10.14	7.0	—11.42	5.70	Depth of river.
Erie canal aqueduct	— 8.14	10.30	—11.09	7.30	—12.42	6.0	—10.26	8.1	—11.63	6.8	Depth on aqueduct foundation.
Canandaigua river north of Erie canal	— 8.30	9.40	—11.51	6.20	—12.64	5.1	—10.52	7.2	—11.98	5.7	Depth of river.
West Shore railroad crossing	— 8.82	6.70	—12.00	3.50	—12.91	2.6	—10.95	4.5	—12.29	3.2	Depth on natural bed.
	......	11.60	......	8.40	......	7.5	......	9.4	......	8.1	Depth in channel dredged.
N. Y. C. and H. R. railroad crossing	— 9.18	8.10	..12.55	4.80	—13.67	3.7	—11.45	5.9	—13.00	4.4	Depth on bridge foundation.
Mosquito Point	—10.52	5.50	..15.41	0.60	—16.57	*	—13.22	2.8	—15.63	0.4	Depth on natural bed.
	......	12.60	......	7.70	......	6.5	......	9.9	......	7.5	Depth in channel dredged.
Cross lake	—12.09	24.40	..17.17	19.30	—17.42	19.1	—14.53	22.0	—17.40	19.1	Depth at iron bridge.

* Bed dry.

TABLE No. 4.

Showing the location of the structures on the Erie canal, from the east line of Oneida county to the East line of Wayne county, with the distances between them, as follows:

FRANKFORT LEVEL, $3\frac{356}{1000}$ MILES.

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	......	East line of Oneida county	.....	.....	......	....	.....
1	3.13	Green's road bridge (Cooper's)	Iron.	.....	$71\frac{6}{12}$	1	.....
	44.72	Stone culvert, three arches	.....	.....	......	....	.....
2	7.97	Starch factory bridge	.....	Wood	$80\frac{11}{12}$	2	.....
	39.94	Stone culvert, three-feet arch	.....	.....	......	....	.....
3	30.55	Clay street bridge, Utica	.....	Iron.	$72\frac{8}{12}$	1	.....
3½	......	Bridge over basin, berme side, Broad street, Utica	Iron.	.....	$52\frac{3}{12}$	1	1
	26.75	Ballou creek, bulkhead and spillway	.....	.....	......	....	.....
4	11.32	Broad street bridge, Utica	Iron.	.....	$90\frac{6}{12}$	2	2
5	7.45	Catherine street bridge, Utica (Swart suspension)	.....	Iron.	$72\frac{9}{12}$	1	2
	......	Pipe culvert	.....	.....	......	....	.....
6	9.23	First street bridge, Utica	Iron.	...	$78\frac{6}{12}$	1	.....
7	8.30	John street bridge, Utica (lift-bridge)	.....	Iron.	$81\frac{4}{12}$	1	2
	1.83	Weigh-lock	.....	.....	......	....	.....
8	8.81	Genesee street bridge, Utica	Iron.	.....	$81\frac{6}{12}$	2	2
9	3.10	Hotel street lift-bridge, Utica	.....	Iron.	......	1	1
10	3.26	Seneca street bridge, Utica	Iron.	.....	73	1	2
11	5.17	Washington street bridge, Utica	Iron.	.....	73	1	2
12	4.74	Broadway foot-bridge, Utica	Iron.	.....	72	....	1
13	10.97	Cornelia street foot-bridge, Utica	.....	Wood	$84\frac{9}{12}$	...	1
	......	Pipe culvert at State street, Utica	.....	.....	......	....	.....

	......	Chenango canal junction	.....	.....	......	....	.....
14	12.62	Whitesboro street bridge, Utica (Sims)	.....	Iron.	$86\frac{11}{12}$	2	2
	3.25	Midland railroad swing-bridge, Utica	.....	.....	......	....	.....
15	8.49	Breeze street foot-bridge, Utica (suspension)	.....	Iron.	$80\frac{9}{12}$	....	.....
	10.57	Stone arch culvert at Nail creek, ten-feet chord	.....	.....	......	....	.....
	4.75	Delaware and Lackawanna railroad swing-bridge, Utica	.....	.....	......	....	.....
	1.00	Foot of lock 46	.....	.....	......	....	.....

ROME LEVEL, $\frac{55}{957}$ MILES.

	......	Lock 46, double stone lock, three-feet lift westward	.....	.....	......	....	.....
16	2.17	Schuyler street bridge, Utica	Iron.	.....	$79\frac{2}{12}$	1	2
17	25.15	Platt street bridge, Utica (foot-bridge)	.....	Iron.	$115\frac{3}{12}$	1	.....
	13.89	Composite culvert 2x2 feet	.....	.....	......	....	.....
19	16.81	Whitesboro road bridge (Bolman suspension)	.....	Iron.	$71\frac{5}{12}$	2	.....
	2.20	Stone-box culvert, 2x2 feet	.....	.....	......	....	.....
	25 48	Composite, drop culvert, 3x3 feet	.....	.....	......	....	.....
20	29.91	Yorkville road bridge (Bolman suspension)	.....	Iron.	79	1	2
	8.04	Double arch culvert, ten-feet chord	.....	.....	......	....	.....
	15.88	Sauquoit creek aqueduct, three spans, twenty-two feet each, stone abutments and pier	.....	.....	......	....	.....
21	37.52	Clinton street bridge, Whitesboro	Iron.	.....	80	1	1
22	26.00	Westmoreland street bridge	Iron.	.....	80	1	2
23	7.25	Babbit's foot-bridge	.....	.....	......	....	1
	14.67	Composite, drop-culvert, two openings, 2½x2 feet each	.....	.....	......	....	.....
24	9.45	Watkins street bridge	.....	Wood	$71\frac{9}{12}$	1	.....
	14.03	Composite, drop-culvert, 2½x2½ feet	.....	.....	......	....	.....
	19.50	Composite, culvert, 2x2 feet	.....	.....	......	....	.....
25	29.22	Bradley road bridge	Iron.	.....	$71\frac{1}{12}$	1	.....
26	92.07	Evens' farm bridge	.....	Wood	$71\frac{4}{12}$	1	.....
27	32.74	Christinan's farm bridge	.....	Wood	$70\frac{6}{12}$	1	.....
...	1.40	Oriskany feeder. The dam and bulk-head of this feeder is located 42.40 chains south of canal	.....	.....	......	....	.....

TABLE No. 4. — *Showing the location of the structures on the Erie canal, etc.* — (Continued).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		ROME LEVEL — (*Continued*).					
	10.63	Oriskany aqueduct, four spans, twenty-two feet each, stone abutments and piers	.....	.....	......	....	.....
28	13.82	River street bridge, Oriskany	Iron.	.....	$79\frac{8}{12}$	1	2
	6.60	Arch culvert, twelve-feet chord	.....	.....	......	....	.....
29	61.33	Brainard's farm bridge	.....	Wood	$72\frac{4}{12}$	1	.....
30	21.33	Parkhurst's farm bridge (iron chord)	.....	Wood	71	1	.....
31	38.89	Kirley's farm bridge (iron chords)	.....	Wood	$71\frac{3}{12}$	1	.....
	21.03	Composite culvert, three openings, 3x2½ feet each	.....	.....	......	....	.....
32	76.96	Murphy's road bridge	.....	Wood	71	1	.....
	93.66	Bulkhead and waste-weir	.....	.....	......	....	.....
33	10.66	Clark's farm bridge	.....	Wood	$71\frac{8}{12}$	1	.....
34	159.83	Stanwix road bridge	Iron.	.....	$79\frac{9}{12}$	1	2
	25.31	Whitehall composite culvert, four openings, 3x4 feet each	.....	.....	......	....	.....
34½	0.65	Road bridge on berme side	.....	Wood	$40\frac{8}{12}$	1	.....
35	5.37	Greenfield road bridge	Iron.	.....	72	1	.....
	40.28	Tow-path bridge (stringer) over old feeder	.....	Wood	......	....	.....
	45.24	Stone arch bridge and bulkhead over feeder—Mohawk feeder The dam is located at $\frac{640}{100}$ chains below feeder, north of canal.	.....	.....	......	....	.....
36	2.20	De Puyster street bridge, Rome	Iron.	.....	$82\frac{3}{12}$	1	.....
	10.86	New York Central and Hudson River railroad bridge	.....	.....	......	....	.....
	1.94	Tubular tow-path bridge over Black River canal	.....	Iron.	......	1	.....
37	5.84	James street bridge, Rome	Iron.	.....	92	2	2
38	10.27	Washington street bridge, Rome	Iron.	.....	$79\frac{5}{12}$	1	2
39	10.85	George street bridge, Rome	Iron.	.....	$72\frac{3}{12}$	1	.....

40	21.40	Jay street bridge, Rome (Simms)		Iron.	$71\frac{10}{12}$	1	
	14.00	Tow-path bridge over Wood creek					
41	1.04	Private foot bridge		Wood	$88\frac{9}{12}$		1
42	26.75	Doxtator avenue bridge (iron chords)		Wood	$111\frac{9}{12}$	1	
	21.00	Rome, Watertown and Ogdensburgh railroad bridge					
43	6.30	Barnes' farm bridge		Wood	71	1	
	76.33	Composite culvert					
44	15.96	Brainard's farm bridge		Wood	71	1	
	24.89	Fort Bull bulk-head and waste-weir (stone)					
	15.29	Arch culvert, four-feet chord					
	81.49	Arch culvert, four-feet chord					
45	17.96	Armstrong's farm bridge		Wood	$71\frac{8}{12}$	1	
	21.65	Composite culvert					
46	30.16	Heweig's road bridge		Wood	72	1	
	35.47	Arch culvert, twelve-feet chord					
47	27.94	Seun's farm bridge		Wood	72	1	
	31.17	Arch culvert, four-feet chord					
48	35.23	Tuttle's road bridge (iron chord)		Wood	$71\frac{5}{12}$	1	
	16.80	Composite culvert, four-feet opening					
49	26.19	Main street bridge, New London	Iron.		$89\frac{2}{12}$	1	2
	37.76	Composite culvert, four-feet opening					
50	2.13	Private foot-bridge					1
	28.95	Composite culvert, four-feet opening					
	24.49	Composite culvert, 4 x 4 feet opening					
51	10.83	Grove Spring road bridge		Wood	$83\frac{6}{12}$	1	
52	9.26	Private foot-bridge					1
	23.17	Composite culvert, 2 x 4 feet opening					
53	19.74	Stacy's Basin road bridge		Wood	74	1	
54	14.16	Private foot-bridge					
	26.69	Composite culvert and bulk-head					
55	23.37	Happy Valley road bridge		Wood	$78\frac{8}{12}$	1	

TABLE No. 4 — *Showing the location of the structures on the Erie canal, etc.* — (Continued).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		ROME LEVEL — (*Continued*).					
	27.35	Composite culvert, three openings	....	....	......	....	.....
	.75	Waste-weir and bulk-head on berme side	....	....	......	....	.....
56	47.04	Swing-bridge over old Oneida Lake canal	.....	Wood	21	1	.....
57	5.14	Higginsville east road bridge	.....	Wood	$73\frac{9}{12}$	1	.....
	27.58	Composite culvert, three-feet openings	.....	.....	......	....	.....
58	473.00	Higginsville west road bridge	Iron	.....	72	1	.....
	21.18	Composite culvert, four-feet opening	.....	.....	......	....	.....
	32.05	Composite culvert, four-feet opening	.....	.....	......	....	.....
59	18.63	Dumbarton road bridge	.....	Wood	$71\frac{7}{12}$	1	.....
	12.88	Composite culvert, four-feet openings	.....	.....	......	....	.....
	26.86	Composite culvert, three-feet openings	.....	.....	......	....	.....
60	10.93	Durkee's road bridge	.....	Wood	$71\frac{5}{12}$	1	.....
	39.66	Composite culvert, one opening	.....	.....	......	....	.....
61	7.58	State road bridge	.....	Wood	$71\frac{3}{12}$	1	.....
	27.36	Composite culverts, two openings, three feet each	.....	.....	......	....	.....
	3.34	Midland railroad bridge	.....	.....	......	....	.....
	53.89	Arch culvert, four-feet chord	.....	.....	......	....	.....
	9.67	Arch culvert, four-feet chord	.....	.....	......	....	.....
	23.81	Brandy Brook arch culvert, twelve-feet chord	.....	.....	......	....	.....
62	16.82	Private suspension foot bridge	.....	.....	......	....	.....
63	26.06	Durhamville east road bridge	Iron	.....	72	1	1
	4.76	Arch culvert, four-feet chord	.....	.....	......	....	.....
64	8.13	Main street bridge, Durhamville	Iron	.....	71	1	2

	7.69	Arch culvert, two spans, each twenty-five-feet chord, bulk-head and spillway, directly over the end of the arch culvert	.....	.....	......	....	.....
65	6.47	Bennett's road bridge (iron chords)	.....	Wood	$71\frac{4}{12}$	1	.....
	4.70	Oneida Creek feeder. The dam and bulk-head of this feeder is located $242\frac{80}{100}$ chains south of the canal	.....	.....	......	....	.....
	2.00	Swing-bridge over Oneida Lake canal	.....	Wood	......	....	.....
66	75.15	Shollhammer's road bridge (iron chords.) The north approach of this bridge is a wooden truss over highway	.....	Wood	$77\frac{4}{12}$	1	.....
	46.51	Cowassalon aqueduct, two spans, twenty feet each	.....	.....	......	....	.....
	9.00	Cowassalon feeder. The dam and bulkhead of this feeder is located $30\frac{15}{100}$ chains south of the canal	.....	.....	......	....	.....
67	80.72	Lenox basin road bridge	.....	Wood	$71\frac{10}{12}$	1	.....
	86.15	Composite culvert, two openings, two and one-half feet each	.....	.....	......	....	.....
	80.23	Composite culvert, one opening	.....	.....	......	....	.....
68	15.09	Peterboro street bridge, Canastota	Iron.	.....	$72\frac{4}{12}$	1	2
	12.52	Arch culvert, two spans, each eight-feet chord	.....	.....	......	....	.....
69	2.84	Main street bridge, Canastota	Iron.	.....	71	1	2
	54.78	Composite culvert, two and one-half feet opening	.....	.....	......	...	.....
70	70.24	Beebee's road bridge (iron chord)	.....	Wood	$71\frac{8}{12}$	1	.....
	25.68	Composite culvert, three openings, three feet each	.....	.....	......	....	.....
71	13.39	Herrick's farm bridge (iron chord)	... .	Wood	72	1	.....
	10.57	New York Central and Hudson River railroad bridge	.....	.....	......	....	.....
	37.38	Composite culvert, three openings	.....	.....	......	....	.....
72	2.07	Fuller's road bridge	.....	Wood	$71\frac{4}{12}$	1	.....
73	67.21	New Boston road bridge	Iron.	.....	71	1	.....
	56.12	Composite culvert over Canasaraga creek, ten openings, three and one-half feet each	.....	.....	......	....	.....
74	32.03	Canasaraga road bridge	Iron.	.....	$99\frac{5}{12}$	1	.....
75	123.97	Chittenango road bridge	Iron.	.....	$93\frac{6}{12}$	1	.....
	3.60	Chittenango feeder. The dam and bulkhead of this feeder is located twenty-two chains south of the canal	.....	.....	......	....	.....

TABLE No. 4 — *Showing the location of the structures on the Erie canal, etc.* — (Continued).

Number of bridges.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		ROME LEVEL — (*Continued*).					
	24.50	Chittenango aqueduct, three spans, twenty feet each.......	....	.....	......	....	.....
	17.38	Arch culvert, four-feet chord	....	.....	......	....	.....
76	39.27	Private foot-bridge	....	.....	......	....	1
77	11.01	Bolivar road bridge....................	....	Wood	70	1	.....
78	8.64	Private foot-bridge (iron chords)....................	....	Wood	......	....	1
	21.59	Arch culvert, five-feet chord	....	.....	......	....	.....
79	49.10	White's road bridge	....	Wood	$71\frac{7}{12}$	1	.....
	86.79	Pool's brook spillway and waste-weir	....	.....	......	....	.....
80	8.56	Pool's brook road bridge....................	....	Wood	$71\frac{2}{12}$	1	.....
81	91.93	Kirkville road bridge	....	Wood	72	1	.....
	38.69	Arch culvert, three-feet chord....................	....	.....	......	....	.....
	35.02	Arch culvert (Lake brook), six-feet chord....................	....	.....	......	....	.....
82	166.63	Manlius Center road bridge (iron chord)....................	....	Wood	71	1	.....
	24.99	Syracuse and Chenango Valley railroad bridge	....	.....	......	....	.....
83	10.01	Stone's farm bridge....................	....	Wood	$72\frac{9}{12}$	1	.....
	20.00	Limestone feeder. (The dam and bulkhead of this feeder is located $70\frac{62}{100}$ chains south of the canal.)					
84	1.00	Limestone feeder change bridge	....	Iron.	$73\frac{9}{12}$	1	.....
	2.01	Limestone creek aqueduct, three spans, twenty feet each...	....	.....	......	....	.....
85	21.45	Private foot-bridge....................	....	.....	......	....	1
86	23.20	Burdick's road bridge....................	....	Wood	$70\frac{8}{12}$	1	.....
	40.38	Composite culvert, four-feet opening	....	.....	......	....	.....
	80.58	Butternut creek aqueduct, three spans, twenty feet each....	....	.....	......	....	.....

	7.00	Butternut creek feeder. (The dam and bulkhead of this feeder is located 160 chains south of the canal.)					
87	1.04	Orville feeder change bridge	.....	Wood	71	1	.....
88	171.30	Thompson's landing road bridge	Iron.	.....	$81\frac{9}{12}$	1	.....
89	66.65	Private farm bridge (at bone yard)	.....	Wood	105	1	.....
	108.11	New York Central and H. R. R. R. viaduct, two arches	.....	.....	......	....	.....
	3.70	Foot of lock 47, stone, double lock $10\frac{175}{1000}$ feet lift eastward.	.....	.....	......	....	.....
		SHORT LEVEL, $0\frac{188}{1000}$ MILES.					
90	6.90	Beech street bridge, Syracuse	Iron	.....	103	1	2
	8.14	Foot of lock 48, stone, double lock, $10\frac{538}{1000}$ feet lift eastward	.....	.....	......	....	.....
		LEVEL BETWEEN LOCKS 48 AND 49, $0\frac{714}{1000}$ MILES.					
91	27.70	William street bridge, Syracuse	Iron.	.....	$79\frac{5}{12}$	1	2
92	22.92	Catharine street bridge, Syracuse	Iron.	.....	97	1	2
	6.50	Foot of lock 49, stone, double lock, $6\frac{991}{1000}$ feet lift eastward.	.....	.....	......	....	.....
		SYRACUSE LEVEL, $5\frac{14}{1000}$ MILES.					
93	0.58	Orange street bridge, Syracuse	Iron.	.....	100	1	2
94	6.91	Grape street bridge, Syracuse	Iron.	.....	$97\frac{3}{12}$	1	2
95	7.19	Mulberry street bridge, Syracuse	Iron.	.....	95	1	2
	5.39	Weigh-lock, and culvert under the canal to empty said weigh-lock	.....	.....	......	....	.....
96	2.66	Tow-path bridge over the Oswego canal at the junction	.....	Iron.	$86\frac{6}{12}$	1	.....
97	3.82	Tow-path bridge over the branch of the junction	.....	Iron.	$66\frac{5}{12}$	1	.....
98	1.73	Warren street bridge, (wrought-iron)	Iron.	.....	70	2	2
99	5.48	Foot bridge on east side of Salina street	....	Iron.	$61\frac{2}{12}$	....	1
100	0.73	Salina street swing-bridge (wrought-iron)	.....	Iron.	90	1	2
101	5.01	Clinton street bridge	Iron.	.....	$71\frac{6}{12}$	1	2
102	7.94	Franklin street foot-bridge	.....	Iron.	$78\frac{5}{12}$	....	1
	0.32	Northern railroad swing-bridge	.....	.....	......	....	.....

TABLE No. 4 — *Showing the location of the structures on the Erie canal* — (Continued).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		SYRACUSE LEVEL — (*Continued*).					
	9.45	Onondaga creek arch culvert, two arches, twenty-five feet-chord each	.....	.....	......	....	.....
	3.23	Waste-weir at Amos' mill on berme side, spillway 100 feet	.....	.....	......	....	.....
103	1.96	West street bridge, Syracuse (lift-bridge)	.....	Iron.	$63\frac{4}{12}$	1	2
	12.90	State race leading to salt works	.....	.....	......	....	.....
104	36.69	Geddes street bridge	Iron.	.....	$72\frac{6}{12}$	1	.....
	14.96	Harbor brook arch culvert, twelve-feet chord	.....	.....	......	....	.....
	1.89	New York Central and Hudson River railroad bridge	.....	.....	......	....	.....
105	37.39	Genesee street bridge, Geddes	Iron.	.....	77	1	2
106	26.56	Bridge street bridge, Geddes	Iron.	.....	$86\frac{6}{12}$	1	1
107	29.61	Salt company's bridge (Main), Geddes	Iron.	.....	$87\frac{7}{12}$	1	.....
	4.22	Arch culvert, three-feet chord	.....	.....	......	....	.....
108	35.92	Blast furnace road bridge, Geddes	Iron.	.....	$71\frac{10}{12}$	1	.....
	14.94	Arch culvert, three-feet chord	.....	.....	......	....	.....
109	53.85	Gere's Landing bridge (iron chords)	.....	Wood	$71\frac{2}{12}$	1	.....
	58.88	Double arch culvert, each arch four-feet chord	.....	.....	......	....	.....
	10.91	To foot of lock 50	.....	.....	......	....	.....
		JORDAN LEVEL, $14\frac{903}{1000}$ MILES.					
	......	Lock 50, stone double lock, $7\frac{872}{1000}$ feet lift westward	.....	.....	......	....	.....
110	16.32	Gere's farm bridge	.....	Wood	$72\frac{4}{12}$	1	.....
	31.03	Arch culvert, three-feet chord	.....	.....	......	....	.....
111	35.83	Bellisle road bridge	Iron.	.....	$71\frac{2}{12}$	1	.....

	60.43	Arch culvert, three-feet chord	.....	.....	......	....	.....
112	11.26	Amboy-road bridge	Iron.	.....	$71\frac{9}{12}$	1	.....
	71.30	Nine-mile creek aqueduct, four spans, thirty-one feet each	.....	.....	......	....	.....
	56.00	Arch culvert, four-feet chord	.....	.....	......	....	.....
	27.36	Nine-mile creek feeder. The dam and bulkhead of this feeder is located $132\frac{20}{100}$ chains south of the canal and just above the village of Camillus	.....	.....	......	....	.....
113	6.70	Camillus road bridge	.....	Wood	72	1	.....
	68.15	Receiver on berme side	.....	.....	......	....	.....
114	100.57	Newport road bridge	.....	Wood	$72\frac{5}{12}$	1	.....
115	205.39	Memphis road bridge (iron chord)	.....	Wood	72	1	2
	63.13	Composite culvert, three openings, three feet each	.....	.....	......	....	.....
116	65.92	Peru road bridge (iron chord)	....	Wood	$72\frac{7}{12}$	1	.....
	70.87	Carpenter-brook feeder. Dam and lock, twelve chains south of canal	.....	.....	......	....	.....
117	3.63	Shanty Point farm bridge	.....	Wood	$71\frac{10}{12}$	1	.....
	1.09	Composite culvert, three openings, four feet each	.....	.....	......	....	.....
	82	Carpenter brook stone waste-weir and bulkhead	.....	.....	......	....	.....
	93.04	Composite culvert, four-feet opening	.....	.....	......	....	.....
119	32.45	Beaver street bridge, Jordan village	.....	Wood	$72\frac{6}{12}$	1	.....
	21.95	Jordan aqueduct, four spans, twenty feet each, and an arch culvert at west end of aqueduct for mill powers	....	.....	......	....	.....
	4.55	Skaneateles feeder. The dam and bulkhead of this feeder is located $7\frac{50}{100}$ chains south of the canal, and in the village of Jordan	.....	.....	......	....	.....
120	2.18	Main street bridge, Jordan	Iron.	.....	$82\frac{1}{12}$	1	2
121	14.32	Hamilton street bridge, Jordan (iron chords)	.....	Wood	$71\frac{9}{12}$	1	.....
	44.75	Arch culvert, six-foot chord	.....	.....	......	....	.....
	32.43	Foot of lock 51, double stone lock, $5\frac{580}{1000}$-foot lift, eastward	.....	.....	......	....	.....

Table No. 4—*Showing the location of the structures on the Erie canal, etc.*—(Continued.)

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		PORT BYRON LEVEL $7\frac{793}{1000}$ MILES.					
	......	Lock 51	.....	.....	......	....	.....
	14.66	Composite culvert, four and one-half-foot openings	.....	.....	......	...	.....
122	11.19	Cold Spring road bridge	.....	Wood	74	1	.....
123	45.44	Fountainville road bridge	.....	Wood	$72\frac{9}{12}$	1	.....
	19.61	Arch culvert, four-feet chord	.....	.....	......	....	.....
124	4.46	Field's road bridge	.....	Wood	$72\frac{7}{12}$	1	.....
	28.29	Composite culvert, four-feet openings	.....	.....	......	....	.....
125	11.50	Private foot-bridge (suspension)	.....	.....	......	....	....
	35.83	Arch culvert, four-feet chord	.....	.....	......	..	.....
126	39.05	Putnam farm bridge	.....	Wood	$72\frac{7}{12}$	1	.....
127	33.38	Young's farm bridge	.....	Wood	72	1	.....
	5.61	Southern Central railroad bridge	.....	.....	......	....	.....
	4.78	Composite culvert, four-feet opening	.....	.....	......	....	.....
	.83	Putnam brook feeder	.....	.....	......	....	.....
	.83	Bulkhead on tow-path side	.....	.....	......	....	.....
128	17.25	Seneca street bridge, Weedsport	Iron	.....	$72\frac{9}{12}$	1	.....
	19.54	Box culvert (stone) 3x3 feet	.....	.....	......	....	.....
129	18.93	Foot-bridge (private)	.....	.....	$72\frac{6}{12}$	....	.....
130	5.25	Brutus street bridge	Iron	....	$76\frac{6}{12}$	1	2
131	9.55	Suspension foot-bridge	....	.....	......	....	....
	22.44	Composite culvert, four-feet opening	.....	.....	......	....	.....
132	33.48	Hamilton farm bridge	.....	Wood	72	1	.....

	1.15	Centerport aqueduct, three spans, twenty feet each, stone abutment and pier	.....	.....	......	....	.....
	54.95	Centerport feeder	.....	.....	......	....	.....
133	1.00	Centerport road bridge	Iron.	.....	$72\frac{4}{12}$	1	2
	43.70	Receiver on berme side	.....	.....	......	....	.....
	35.17	Composite culvert, four-feet opening	.....	.....	......	....	....
	32.01	Composite culvert, two openings, three feet each	.....	.....	......	....	.....
134	4.02	Utica street bridge, Port Byron	Iron.	.....	100	1	.....
135	9.46	Main street bridge, Port Byron	Iron.	.....	$71\frac{10}{12}$	1	2
	3.01	Arch culvert, four-feet chord	.....	.....	......	....	.....
	14.84	Port Byron aqueduct, four spans, twenty-one feet each, stone abutments and piers	....	.....	......	....	.....
	2.97	Port Byron feeder. The dam and bulkhead of this feeder is located 170 chains south of the canal and south of the village of Port Byron, the water is conducted from the end of the open channel at the well-house to the canal, through an iron pipe forty-two inches in diameter and 859 feet along	.....	.....	......	....	.....
136	5.74	Owasco street bridge, Port Byron	Iron.	.....	$75\frac{5}{17}$	1	2
137	7.94	Canal street bridge, Port Byron	Iron.	.....	72	1	.....
	15.38	Arch culvert, six-feet chord	.....	.....	......	....	.....
	2.80	Lock 52, stone double lock, $11\frac{417}{1000}$ foot lift eastward	.....	.....	......	....	.....
		MONTEZUMA LEVEL TO WAYNE COUNTY LINE, $9\frac{98}{1000}$ MILES.					
		Foot of lock 52	.....	.....	......	....	.....
138	61.96	Houghtaling road bridge	Iron.	.....	72	1	.....
	148.30	Composite culvert, 3x4 feet openings	.....	.....	......	....	.....
139	5.60	McLeod's road bridge	Iron.	.....	$71\frac{10}{12}$	1	.....
	9.77	Crane brook aqueduct, 3 spans, 20 feet each, stone abutments and piers	.....	.....	......	....	.....
140	9.02	Bucklin's farm bridge (old style)	.....	Wood	72	1	.....
	75.79	Arch culvert, 4 feet chord	.....	.....	......	....	.....

TABLE No. 4—*Showing the location of the structures on the Erie canal, etc.*—(Continued).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		MONTEZUMA LEVEL TO WAYNE COUNTY LINE, ETC.—(*Continued*).					
	1.38	Spillway at Montezuma, 82 feet wide	.....	.....	......	....	.....
141	1.99	Salt street road bridge, Montezuma	Iron.	.....	$72\frac{4}{12}$	1	.....
142	4.12	High street foot bridge (tubular)	Iron.	.....	$80\frac{4}{12}$	....	1
	0.26	Cayuga and Seneca canal junction	.....	.....	......	....	.....
143	2.40	Change bridge at junction	.....	Wood	$72\frac{2}{12}$	1	.....
	22.08	Arch street bridge, four-feet chord	.....	.....	......	....	.....
144	2.01	Clark street bridge, Montezuma	.....	Wood	$72\frac{7}{12}$	1	.....
	35.79	Seneca river aqueduct, thirty-one spans, twenty-two feet each, stone abutment and piers	.....	.....	......	....	.....
145	184.53	May's Point road and change bridge	.....	Wood	72	1	.....
	20.79	Composite culvert, two openings, three feet each	.....	.....	......	....	.....
	80.97	Composite culvert, two openings, three feet each	.....	.....	......	....	.....
	59.45	End of the middle division at Wayne county line	.....	.....	......	....	.....

TABLE No. 4 — *Showing the length of levels on the Oswego canal and the structures on each in their order* — (Continued).

LEVEL No. 1, $137\frac{13}{100}$ CHAINS — (Commencing at the junction of the Erie and Oswego canals at Syracuse).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		Change bridge, connected with James street bridge........	Iron.	....	$74\frac{6}{12}$	1	.....
1	......	James street bridge, Syracuse....................	Iron.	....	$74\frac{6}{12}$	2	2
2	......	Willow street bridge, Syracuse	Iron.	....	$76\frac{6}{12}$	2	2
3	......	Salina street (lift-bridge), Syracuse	Iron.	....	105	2	2
		Syracuse and Chenango Valley railroad swing-bridge	.....	....	......	...	.....
4	......	Division street bridge, Syracuse........................	Iron.	....	74	1	2
5	......	Bear street bridge, Salina	Iron.	....	$79\frac{6}{12}$	1	2
	......	Spillway No. 1, at Haskin's mill, sixty-five feet long	.....	....	......	....	.....
6	......	Salina street bridge, Salina............................	Iron.	....	72	1	2
	......	Discharge from salt works..............................	.....	....	......	....	.....
	......	Lock No. 1, stone, eleven-feet lift to southward............	.....	....	......	....	.....
		LEVEL No. 2, $11\frac{95}{100}$ CHAINS.					
	......	Covered sluice around locks Nos. 1 and 2, 430 feet long.....	.....	....	......	....	.....
7	......	Park street bridge, Salina..............................	Iron.	....	72	1	2
	......	Lock No. 2, stone, eleven-feet lift southward	.....	....	......	....	.....
		LEVEL No. 3, 10 CHAINS.					
	......	Spillway No. 2, on berme side, feet long...	.....	....	......	....	.....
	......	Lock No. 3, stone, ten and one-half-feet lift..............	.....	....	......	....	.....
		LEVEL No. 4, $433\frac{76}{100}$ CHAINS.					
	......	Lock No. 4, stone, on side-cut to salt-works	.....	.....	......	...	.....
7½	......	Free bridge over said side-cut..........................	.....	Wood	33	1	.....

TABLE No. 4 — *Showing the length of the levels and structures on the Oswego canal* — (Continued).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		LEVEL No. 4 — (*Continued*).					
	......	Spillway No. 3, on main canal, — feet long	.....	.....	......	....	.....
8	......	Change bridge	.....	Wood	$87\frac{9}{12}$	1	.....
	......	Side-cut to salt-works	.....	.....	......	....	.....
	......	New York Central and Hudson River railroad bridge	.....	.....	......	....	.....
	......	Spillway No. 4, stone, — feet long	.....	.....	......	....	.....
9	......	Greenpoint road and change bridge (iron chord)	.....	Wood	$75\frac{6}{12}$	1	T. P.
	......	Syracuse and Northern railroad bridge	.....	.....	......	....	.....
	......	Stone culvert at Liverpool	.....	.....	......	....	.....
	......	Spillway No. 5, — feet long	.....	.....	......	....	.....
10	......	Liverpool road bridge	.....	Wood	74	1	.....
	......	Culvert	.....	.....	......	....	.....
11	......	Change bridge, Whipple pipe	Iron	.....	$72\frac{6}{12}$	1	.....
	......	Approach on east side of bridge No. 11	.....	Wood	47	1	.....
$11\frac{1}{2}$	.....	Outlet bridge	Iron	.....	83	1	.....
	......	Bulkhead just above lock No. 5, sixteen feet long	.....	.....	......	....	.....
	......	Lock No. 5, $9\frac{68}{100}$ feet lift southward	.....	.....	......	....	.....
		LEVEL No. 5, $1011\frac{1}{100}$ CHAINS.					
	......	One sluice, wood, through tow-path	.....	.....	......	....	.....
12	......	Cold spring bridge	Iron	.....	115	1	.....
	......	Eleven sluices, wood, through tow-path	.....	.....	......	....	.....
13	......	Belgium road bridge	Iron	.....	108	1	.....
	......	Seven sluices, wood, through tow-path	.....	.....	......	....	.....

14	......	Three River Point tow-path and road bridge, six spans, whole length of bridge 316 feet	....	Wood	......	1	.....
	......	Five sluices, wood, through tow-path	....	....	......	....	.....
	......	One sluice, stone, through tow-path	....	....	......	....	.....
	......	Two sluices, wood, through tow-path	....	....	......	....	.....
15	......	Lock street bridge (iron chords) connected with river bridge at Phœnix	....	Wood	74	1	.....
	......	Guard-lock No. 1, at Phœnix (stone)	....	....	......	....	.....
	......	Phœnix dam, stone spillway, 440 feet long	....	....	......	....	.....
16	......	Bridge street bridge, Phœnix (iron chords)	....	Wood	72	1	.....
17	......	Change and road bridge	....	Wood	72	1	T. P.
18	......	Change bridge at Hinmanville	....	Wood	72	1	.....
19	......	Hinmanville road bridge (iron chords)	....	Wood	73	1	.....
	......	Lock No. 6, seven-feet lift, southward	....	....	......	....	.....
		LEVEL No. 6, $188\frac{20}{100}$ CHAINS.					
	......	Seven sluices, wood abutments, tow-path side	....	....	......	....	.....
	......	Guard-lock No. 2, stone	....	....	......	....	.....
	......	Spillway No. 6, on berme side	....	....	......	....	.....
	......	Lock No. 7, $5\frac{866}{1000}$ feet lift, southward	....	....	......	....	.....
		LEVEL No. 7, $291\frac{97}{100}$ CHAINS.					
	......	Eleven sluices, wood abutment, through tow-path	....	....	......	....	.....
	......	Guard-lock No. 3, stone	....	....	......	....	.....
20	......	South Fulton road bridge	....	Wood	72	1	.....
	......	Oswego Falls dam, stone spillway, 413 feet long	....	....	......	....	.....
	......	Spillway No. 7, on berme side	....	....	......	....	.....
21	......	Broadway bridge, Fulton (road)	Iron.	....	79	1	2
	......	Lock No. 8, $11\frac{25}{100}$ feet lift, southward	....	....	......	....	.....

TABLE No. 4 — *Showing the length of the levels and structures on the Oswego canal* — (Continued).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		LEVEL No. 8, $45\frac{86}{100}$ CHAINS.					
	......	Side-cut lock (Fulton Mills)	.....	.....	......	....	.....
	......	Fulton dam, stone spillway, 503 feet long	.....	.....	......	....	.....
22	......	First street bridge, Fulton	Iron.	.....	82	1	2
23	......	Oneida street bridge, Fulton	Iron.	.....	77	1	2
	......	Spillway No. 8 at head of lock 9	.....	.....	......	....	.....
	......	Lock No. 9, $7\frac{25}{100}$ feet lift, southward	.....	.....	......	....	.....
		LEVEL No. 9, $9\frac{70}{100}$ CHAINS.					
	......	Lock No. 10, nine-feet lift, southward	.....	.....	......	....	.....
	......	State shop	.....	.....	......	....	.....
		LEVEL No. 10, $113\frac{35}{100}$ CHAINS.					
	......	Foot bridge (private)	.....	.....	......	....	.....
	......	Aqueduct No. 1 (one span)	.....	.....	......	....	.....
24	......	Road and change bridge	Iron.	.....	77	1	T. P.
25	......	Plank-road bridge	Iron.	.....	72	1	.....
26	......	Change bridge (iron chords)	.....	Wood	72	1	.....
	......	Lock No. 11, $11\frac{666}{1000}$ feet lift, southward	.....	.....	......	....	.....
		LEVEL No. 11, $339\frac{10}{100}$ CHAINS.					
	......	Ten sluices, wood abutments, through tow-path	.....	.....	......	....	.....
	......	Guard lock No. 4 (Battle island)	.....	.....	......	....	.....
	......	Van Buren dam, stone spillway, 662 feet long	.....	.....	......	....	.....

27	......	Change bridge	.....	Wood	74	1	.....
28	......	Change bridge	.....	Wood	74	1	.....
	......	Three sluices, wood abutments, tow-path side	.....	.....	......	....	.....
	......	Lock No. 12, $11\frac{25}{100}$ feet lift, southward	.....	.....	......	....	.....
		LEVEL No. 12, $59\frac{40}{100}$ CHAINS.					
	......	Minetto dam, stone spillway, 445 feet long	.....	.....	......	....	.....
29	......	Minetto road bridge	Iron	.....	74	1	.....
	......	Lock No. 13, $5\frac{65}{100}$ feet lift, southward	.....	.....	......	....	.....
		LEVEL No. 13, $91\frac{70}{100}$ CHAINS.					
	......	Two sluices, wood abutments, tow-path side	.....	.....	......	....	.....
	......	One sluice, stone abutment, tow-path side	.....	.....	......	....	.....
	......	Lock No. 14, $9\frac{25}{100}$ feet lift, southward	.....	.....	......	....	.....
		LEVEL No. 14, $82\frac{26}{100}$ CHAINS.					
	......	High dam, stone spillway, 363 feet long	.....	.....	......	....	.....
	......	Lock No. 15, $5\frac{75}{100}$ feet lift, southward	.....	.....	......	....	.....
		LEVEL No. 15, $31\frac{52}{100}$ CHAINS.					
	......	Spillway No. 9, on berme side	.....	.....	......	....	.....
	......	Lock No. 16, $8\frac{666}{1000}$ feet lift, southward	.....	.....	......	....	.....
		LEVEL No. 16, $100\frac{96}{100}$ CHAINS.					
	......	Sluice No. 62, stone abutments, through tow-path	.....	.....	......	....	.....
	......	Oswego dam, stone spillway, 530 feet long	.....	.....	......	....	.....
	......	Guard-lock No. 5	.....	.....	......	....	.....
	......	Weigh-lock	.....	.....	......	....	.....
30	......	Bridge over the canal to the mills (iron chords)	.....	Wood	$80\frac{9}{12}$	1	.....
	......	Culvert from race to mills	.....	.....	......	....	.....
	......	Spillway No. 10	.....	.....	......	....	.....
	......	Lock No. 17, $10\frac{50}{100}$ feet lift, southward	.....	.....	......	....	.....

TABLE No. 4 — *Showing the length of the levels and structures on the Oswego canal* — (Continued).

Number of bridge.	Distances in chains and links.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridges.	Number of roadways.	Number of sidewalks.
		LEVEL No. 17, $20\frac{95}{100}$ CHAINS.					
	......	Culvert	.....	.....	......	....	.....
	......	Main street bridge, Oswego	.....	.....	......	....	.....
	......	Railroad bridge	.....	.....	......	....	.....
	......	Lock No. 18, $9\frac{25}{100}$ feet lift, southward, at high water, and $13\frac{33}{100}$ feet lift, southward, at low-water mark	.....	.....	......	....	.....
		LEVEL OF OSWEGO HARBOR AND LAKE ONTARIO.					
	......	River wall, on berme side, extends from lock No. 18 $11\frac{80}{100}$ chains to the north line of Bridge street, and fifty chains from Bridge street to mouth of harbor. State shop is located on the berme side of lock 18.					
		SIDE-CUT LEVEL, 0.75 MILES.					
	......	Bridge at Flouring Mill (iron chord)	....	Wood	48	1	.....
	......	Bridge at Main street	Iron	.....	$48\frac{6}{12}$	1	2
	......	Guard-lock (stone)	....	.....	......	....	.....
	......	River dam, 385 feet long	....	.....	......	....	.....
	......	Bridge at Jack's Reef	Iron	.....	98	1	.....

TABLE No. 4 — *Oneida River Improvement, from Three River Point to Brewerton, twenty miles.*

GENERAL DESCRIPTION.	Trapezoidal truss.	Span of bridge.	Number of roadways.
The structures are:			
One tree dam at Oak Orchard	....	....	....
One steamboat lock at Oak Orchard, 120 feet long and thirty feet wide, three-feet lift	....	....	....
One swing-bridge, ninety-five feet long, forty-five-feet opening	Wood	45	1
One crib and stone dam at Caughdenoy	....	....	....
One steamboat lock at Caughdenoy, 120 feet long and thirty feet wide, three-feet lift	....	....	....
One swing-bridge over lock, thirty-one feet opening	Wood	45	1
One swing-bridge at Brewerton, eighty-five feet long, forty-five-feet opening, fourteen feet wide,	Wood	45	1

TABLE NO. 4 — *Showing the length of the levels on the Cayuga and Seneca canal, from Geneva to the junction of the Erie canal at Montezuma, and the structures on each in their order, including the Cayuga side-cut from Mud Lock to Cayuga bridge and Cayuga inlet.*

SENECA LAKE LEVEL NO. 1, 650 CHAINS.

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
1	Lake street bridge, Geneva	Iron.	.....	72	2	2
	Two swing-bridges	.....	Wood	......	....	.....
2	Evins street bridge, Geneva	Iron.	.....	80	1	.....
	Tow-path bridge No. 1, 270 feet long	.....	.....	......	....	.....
3	Preëmption road bridge (new)	Iron.	.....	72	1	.....
4	Teal's road bridge	Iron.	.....	74	1	.....
5	New outlet bridge	Iron.	.....	82	1	.....
	Geneva and Ithaca railroad bridge	.....	.....	......	....	.....
	Waterloo dam, 212 feet long	.....	.....	......	....	.....
6	Locust street road and change bridge, Waterloo	Iron.	.....	90	1	.....
7	Virginia street bridge, Waterloo	Iron.	.....	82	2	2
	Lock No. 1, $7\frac{28}{100}$ feet lift, westward	.....	.....	......	....	.....
	LEVEL NO. 2, 13 CHAINS.					
8	Bridge on Short level	Iron.	.....	70	1	2
	Lock No. 2, seven-feet lift, westward	.....	.....	......	....	.....

	LEVEL No. 3, 258 $\frac{26}{100}$ CHAINS.					
	Tow-path bridge No. 2, 122 feet long					
9	Graham road bridge		Wood	74	1	
	Tow-path bridge No. 3, 159 feet long					
	Tow-path bridge No. 4, 167 feet long					
10	Kingdom road bridge		Wood	74	1	
	Sodus bay railroad bridge					
11	Bridge street bridge, Seneca Falls	Iron		74	2	2
	Seneca Falls stone dam, 180 feet long					
	Spillway on tow-path side					
	Lock No. 3, ten-feet lift westward					
	LEVEL No. 4, 7 CHAINS LONG.					
	Tow-path bridge No. 5, 102 feet long					
	Lock No. 4, nine-feet lift westward					
	LEVEL No. 5, 9 $\frac{28}{100}$ CHAINS LONG.					
12	Ovid street bridge (Seneca Falls)	Iron		61	2	2
	Lock No. 5, nine-feet lift westward					
	LEVEL No 6, 32 $\frac{45}{100}$ CHAINS LONG.					
	Spillway, 217 feet long					
13	Change and road bridge, old style		Wood	76	1	
	Lock No. 6, 9 $\frac{60}{100}$ feet lift southward					
	LEVEL No 7, 39 $\frac{5}{100}$ CHAINS LONG.					
	Tow-path bridge No. 6, 242 feet long					
	Dam, 217 feet long					
	Lock No. 7, six-feet lift going west					

TABLE No. 4 — *Showing the length of the levels on the Cayuga and Seneca canal, etc.* — (Continued).

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	LEVEL No. 8, 268 CHAINS LONG.					
14	De Mont's bridge (road)	.....	Wood	72	1	.....
	River dam on berme side	.....	.....	......	....	.....
	Lock No. 8, $5\frac{70}{100}$ lift westward	.....	.....	......	....	.....
	LEVEL No. 9, EIGHT CHAINS LONG.					
	This level crosses Cayuga outlet on same level with Cayuga lake	.....	.....	......	....	.....
	Tow-path bridge, No. 7 (over outlet), 268 feet long	.....	....	......	....	.....
	LEVEL No. 10, $388\frac{60}{100}$ CHAINS LONG.					
	Lock No. 9, ten-feet lift, eastward	.....	.....	......	....	.....
15	Change bridge at junction with the Cayuga side-cut	.....	Wood	72	1	.....
16	Free road bridge	Iron	.....	74	1	.....
	Diving culvert, No. 1 (small)	.....	.....	......	....	.....
17	Stahlnecker's farm bridge	.....	Wood	76	1	.....
	Seven diving culverts (small)	.....	.....	......	....	.....
	Ransom's road bridge	.....	Wood	74	1	.....
	Diving culvert, No. 9	.....	.....	......	....	.....
	LEVEL No. 11, MONTEZUMA, 9 CHAINS LONG, TO JUNCTION WITH ERIE CANAL.					
	Lock No. 11, three-feet lift, going east	.....	.....	......	....	.....

CAYUGA BRANCH LEVEL, $153\frac{12}{100}$ CHAINS.					
Lock No. 10, ten-feet lift, eastward	.....	.....	......	.....	.....
Swing-bridge over lock chamber	.....	.....	......	.....	.....
CAYUGA LAKE LEVEL, $15\frac{12}{100}$ CHAINS.					
Tow-path bridge, No. 8, twenty-four feet long	.....	.....	......	.....	.....
N. Y. C. and H. R. R. R. lift-bridge	.....	.....	......	.....	.....
Pier at Cayuga, 654 feet long	.....	.....	......	.....	.....

TABLE No. 4 — *Showing the length of the levels on the Black River canal, and the structures on each in their order.*

Intersection with Erie canal at Rome.

LEVEL No. 1, $6\frac{50}{100}$ CHAINS.

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezodial truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
1	Whitesboro street bridge, Rome (stone abutments),	Iron.	.....	72	1	1
	LEVEL No. 2, $16\frac{57}{100}$ CHAINS.					
	Lock No. 1, ten-feet lift, northward	.....	.....	......	....	.....
2	Dominick street bridge, Rome (stone abutments),	Iron.	.....	56	2	2
	LEVEL No. 3, $14\frac{4}{100}$ CHAINS.					
	Lock No. 2, ten-feet lift, northward	.....	.....	......	....	.....
3	Stanwix street bridge (stone abutments)	Iron.	.....	51	1	2
	LEVEL No. 4, $32\frac{14}{100}$ CHAINS.					
	Lock No. 3, ten-feet lift, northward	.....	.....	......	....	.....
4	Thomas street bridge, Rome (stone abutments and iron chord)	.....	Wood	$50\frac{6}{12}$	1	1
	LEVEL No. 5, $52\frac{68}{100}$ CHAINS.					
	Lock No. 4, ten-feet lift, northward	.....	.....	......	....	.....
5	Huntington farm bridge (on bents, iron chords)	.....	Wood	52	1	.....
	LEVEL No. 6, $55\frac{1}{100}$ CHAINS.					
	Lock No. 5, ten-feet lift, northward	.....	.....	......	....	.....

6	Dunham farm bridge (stone abutments on tow-path side and bents on berme side)	.....	Wood	52	1	.....
	LEVEL No. 7, $229\frac{52}{100}$ CHAINS.					.....
	Lock No. 6, ten-feet lift, northward	.....	.....	......	....	.....
7	Water-works bridge (on bents)	.....	Wood	52	1	.....
8	Farm bridge (on bents)	.....	Wood	52	1	.....
9	Farm bridge (on bents)	.....	Wood	52	1	.....
10	Farm bridge (on bents)	.....	Wood	52	1	.....
	Culvert No. 1, (arch)	.....	.....	......		.....
	Spillway No. 1, (near culvert)	.....	.....	......		.....
11	Farm bridge (on bents)	.....	Wood	52	1	.....
12	Road bridge, near river crossing (on bents)	.....	Wood	52	1	.....
	LEVEL No: 8, $38\frac{2}{100}$ CHAINS.					
	Lock No. 7, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 9, $10\frac{84}{100}$ CHAINS.					
	Lock No. 8, eleven-feet lift, northward	.....	.....	......	....	.....
	Aqueduct No. 1, over Black river, stone abutments and wood trunk, four spans, forty feet; each pier five feet wide. Delta feeder is taken into the canal seventy-five links north of the aqueduct	.....	.....	......	....	.....
	LEVEL No. 10, $11\frac{4}{100}$ CHAINS.					
	Lock No. 9, twelve-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 11, $12\frac{43}{100}$ CHAINS.					
	Lock No. 10, eleven-feet lift, northward	.....	.....	......	....	.....
13	Change and road bridge (on bents)	....	Wood	52	1	.....
	LEVEL No. 12, $8\frac{29}{100}$ CHAINS.					
	Lock No. 11, eleven-feet lift, northward	.....	.....	......	....	.....

TABLE No. 4—*Showing the length of the levels on the Black River canal, and the structures on each in their order*—(Continued).

LEVEL No. 13, $36\frac{86}{100}$ CHAINS.

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	Lock No. 12, eleven-feet lift, northward	.....	.....	......	....	.....
14	Road bridge (stone abutments)	.....	Wood	52	1	.....
	LEVEL No. 14, $168\frac{30}{100}$ CHAINS.					
	Lock No. 13, eight-feet lift, northward	.....	.....	......	....	.....
	Spillway No. 2	.....	.....	......	....	.....
15	Farm bridge (stone abutments and iron chords)	.....	Wood	52	1	.....
16	Farm bridge (on bents)	.....	Wood	52	1	.....
17	Farm bridge (on bents)	.....	Wood	52	1	.....
	Spillway No. 3	.....	.....	......	....	.....
18	Road bridge at Westernville (stone abutments)	.....	Wood	51	1	.....
19	Road bridge (on bents)	.....	Wood	52	1	.....
	LEVEL No. 15, $10\frac{20}{100}$ CHAINS.					
	Lock No. 14, eight-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 16, $12\frac{87}{100}$ CHAINS.					
	Lock No. 15, eight-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 17, $120\frac{73}{100}$ CHAINS.					
	Lock No. 16, ten-feet lift, northward	.....	.....	......	....	.....
20	Westernville road bridge (stone abutments and iron chords)	.....	Wood	60	1	.....

21	Farm bridge (on bents)	.....	Wood	52	1	.....
22	Farm bridge (on bents)	.....	Wood	52	1	.....
	LEVEL No. 18, $46\frac{26}{100}$ CHAINS.					
	Lock No. 17, eight-feet lift, northward	.....	.....	......	....	.....
	Aqueduct No. 2 (Willis creek), stone abutments and piers, wood trunks, six spans eighteen feet each, pier five feet wide	.....	.....	......	....	.....
23	Waldo Farm bridge (on bents)	.....	Wood	52	1	.....
24	Farm bridge (on bents)	.....	Wood	52	1	.....
	LEVEL No. 19, $19\frac{94}{100}$ CHAINS.					
	Lock No. 18, ten-feet lift, northward	.....	.....	......	....	.....
25	Farm bridge (on bents)	.....	Wood	52	1	.....
	LEVEL No. 20, $12\frac{95}{100}$ CHAINS.					
	Lock No. 19, eight-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 21, $11\frac{83}{100}$ CHAINS.					
	Lock No. 20, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 22, $44\frac{29}{100}$ CHAINS.					
	Lock No. 21, ten-feet lift, northward	.....	.....	......	....	.....
26	Old plank-road bridge (stone abutments)	....	Wood	52	1	.....
27	Road bridge (stone abutments on tow-path side, and bents on berme side)	.....	Wood	52	1	.....
	LEVEL No. 23, $69\frac{20}{100}$ CHAINS.					
	Lock No. 22, ten feet lift, northward	.....	.....	......	....	.....
	Aqueduct No. 3 (Stringer's creek), stone abutments and piers, wood trunk, four spans, eighteen feet each, piers five feet wide	.....	.....	......	....	.....
28	Side Hill road bridge, stone, abutments	Iron.	.....	52	1	.....

TABLE No. 4 — *Showing the length of the levels on the Black River canal, and the structures on each in their order* — (Continued).

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	LEVEL No. 24, $29\frac{10}{100}$ CHAINS.					
	Lock No. 23, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 25, $39\frac{55}{100}$ CHAINS.					
	Lock No. 24, ten-feet lift, northward	.....	.....	......	....	.....
29	Road and change bridge (on bents, iron chords)	....	Wood	50	1	.....
	Sluice on tow-path side (stone abutments)	.....	.....	......	....	.....
	LEVEL No. 26, $30\frac{52}{100}$ CHAINS.					
	Lock No. 25, ten-feet lift, northward	....	.....	......	....	.....
	Aqueduct No. 4 (Lansingkill), stone abutments and piers, wood trunks, six spans, eighteen feet each, five piers, — feet wide	.....	.....	......	....	.....
	LEVEL No. 27, $29\frac{93}{100}$ CHAINS.					
	Lock No. 26, ten-feet lift, northward	....	.....	......	....	.....
	LEVEL No. 28, $22\frac{24}{100}$ CHAINS.					
	Lock No. 27, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 29, $12\frac{16}{100}$ CHAINS.					
	Lock No. 28, ten-feet, lift northward	....	.....	......	....	.....
	LEVEL No. 30, $36\frac{49}{100}$ CHAINS.					
	Lock No. 29, ten-feet lift, northward	.....	.....	......	....	.....

30	Road bridge, on bents	.....	Wood	52	1	.....
	Culvert No. 2, arch	.....	.....	......	....	.....
	LEVEL No. 31, $16\frac{60}{100}$ CHAINS.					
	Lock No. 30, ten-feet lift northward	.....	.....	......	....	.....
	LEVEL No. 32, $33\frac{40}{100}$ CHAINS.					
	Lock No. 31, ten-feet lift northward	.....	.....	......	....	.....
	Culvert No. —, arch	.....	.....	......	....	.....
	LEVEL No. 33, 31 CHAINS.					
	Lock No. 32, ten-feet lift northward	.....	.....	......	....	.....
	LEVEL No. 34, $17\frac{82}{100}$ CHAINS.					
	Lock No. 33, ten-feet lift northward	.....	.....	......	....	.....
	Lansingville dam and feeder on tow-path side, abutments of dam and bulkhead of stone masonry	.....	.....	......	....	.....
	LEVEL No. 35, $12\frac{52}{100}$ CHAINS.					
	Lock No. 34, ten-feet lift northward	.....	.....	......	....	.....
	LEVEL No. 36, $11\frac{92}{100}$ CHAINS.					
	Lock No. 35, ten-feet lift northward	.....	.....	......	...	.....
	LEVEL No. 37, $11\frac{83}{100}$ CHAINS.					
	Lock No. 36, ten-feet lift northward	.....	.....	......	....	.....
	Culvert No. 3, arch	.....	.....	......	....	.....
	LEVEL No. 38, $12\frac{22}{100}$ CHAINS.					
	Lock No. 37, ten-feet lift northward	.....	....	......	....	.....
	LEVEL No. 39, $15\frac{62}{100}$ CHAINS.					
	Lock No. 38, ten-feet lift northward	....	.....	......	....	.....
	Spillway No. 4, on tow-path-side	.....	.....	......	....	.....

TABLE No. 4 — *Showing the length of the levels on the Black River canal, and the structures on each in their order* — (Continued).

LEVEL No. 40, $24\frac{7}{100}$ CHAINS.

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	Combined locks, Nos. 39, 40, 41, 42 and 43, each ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 41, $36\frac{16}{100}$ CHAINS.					
	Combined locks Nos. 44, 45 and 46, each ten-feet lift, northward	.....	.....	......	....	.....
31	Road bridge over lock 46 (stone abutments)	.....	Wood	52	1	.....
	LEVEL No. 42, $\frac{27}{100}$ CHAINS.					
	Lock 47, ten-feet lift, northward					
32	Road bridge, on bents	.....	Wood	52	1	.....
	Spillway No. 5, and bulkhead on tow-path side					
	LEVEL No. 43, $9\frac{11}{100}$ CHAINS.					
	Lock No. 48, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 44, $8\frac{68}{100}$ CHAINS.					
	Lock No. 49, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 45, $18\frac{40}{100}$ CHAINS.					
	Lock No. 50, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 46, $15\frac{2}{100}$ CHAINS.					
	Lock No. 51, ten-feet lift, northward	.....	.....	......	....	.....

	LEVEL No. 47, 9$\frac{22}{100}$ CHAINS.					
	Lock No. 52, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 48, 13$\frac{88}{100}$ CHAINS.					
	Lock No. 53, ten-feet lift, northward	.....	.....	......	....	.....
33	Road bridge (on bents)	.....	Wood	53	1	.....
	LEVEL No. 49, 16$\frac{20}{100}$ CHAINS.					
	Lock No. 54, ten-feet lift, northward	.....	.....	......	....	.....
	Culvert No. 4, arch	.....	.....	......	....	.....
	LEVEL No. 50, 9$\frac{33}{100}$ CHAINS.					
	Lock No. 55, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 51, 16$\frac{63}{100}$ CHAINS.					
	Lock No. 56, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 52, 15$\frac{28}{100}$ CHAINS.					
	Lock No. 57, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 53, 24$\frac{8}{100}$ CHAINS.					
	Combined locks 58, 59, 60, each ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 54, 21$\frac{28}{100}$ CHAINS.					
	Lock No. 61, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 55, 22$\frac{20}{100}$ CHAINS.					
	Lock No. 62, ten-feet lift, northward	.....	.....	......	....	.....
	Dam and bulkhead, Lansingkill feeder	.....	.....	......	....	.....
	Tow-path stringer bridge, five spans, 21 feet and 8 inches each	.....	Wood	......	1	.....
	LEVEL No. 56, 10$\frac{8}{100}$ CHAINS.					
	Lock No. 63, ten-feet lift, northward	.....	.....	......	....	.....

TABLE No. 4—*Showing the length of the levels on the Black River canal, and the structures on each in their order*—(Continued).

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	LEVEL No. 57, $43\frac{41}{100}$ CHAINS.					
	Lock No. 64, ten-feet lift, northward	.....	.....	......	....	.....
34	Road bridge (on bents)	.....	Wood	52	1	.....
	LEVEL No. 58, $25\frac{32}{100}$ CHAINS.					
	Lock No. 65, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 59, $25\frac{82}{100}$ CHAINS.					
	Lock No. 66, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 60, $8\frac{91}{100}$ CHAINS.					
	Lock No. 67, ten-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 61, $9\frac{1}{100}$ CHAINS.					
	Lock No. 68, nine-feet lift, northward	.....	.....	......	....	.....
	LEVEL No. 62, $14\frac{10}{100}$ CHAINS.					
	Lock No. 69, nine-feet lift, northward	.....	.....	......	....	.....
35	Road bridge (road from Boonville to Rome)	Iron	.....	52	1	.....
	LEVEL No. 63, $185\frac{88}{100}$ CHAINS.					
	Lock No. 70, nine-feet lift, northward	.....	.....	......	....	.....
	Spillway No. 6 (on tow-path side)	.....	.....	......	....	.....

	Black River railroad bridge	.....	.....	......	....	.....
36	Owen farm bridge (on bents)	.....	Wood	52	1	.....
	Stringer bridge (on tow-path)	.....	.....	......	....	.....
37	Turnpike bridge, Boonville (stone abutments)	Iron.	.....	52	1	....
38	Black river feeder bridge (stone abutments)	.....	Wood	60	1	.....
	Spillway No. 7, tow-path side (stone abutments)	.....	.....	......	....	.....
	Lock No. 71, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 64, $39\frac{3}{100}$ CHAINS.					
39	Main street bridge, Boonville	Iron.	.....	54	1	2
	Culvert No. 5, arch, ten-feet chord	.....	.....	......	....	.....
	Lock No. 72, ten-feet lift, southward	.....	.....	......	....	....
	LEVEL No. 65, $55\frac{34}{100}$ CHAINS.					
	Culvert No. 6, arch	.....	.....	......	....	.....
40	Farm bridge (on bents)	.....	Wood	52	1	.....
41	Farm bridge (on bents)	.....	Wood	52	1	.....
	Lock No. 73, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 66, $11\frac{55}{100}$ CHAINS.					
	Lock No. 74, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 67, $55\frac{86}{100}$ CHAINS.					
42	Carpenter farm bridge (on bents)	.....	Wood	52	1	.....
	Lock No. 75, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 68, $16\frac{39}{100}$ CHAINS.					
	Locks Nos. 76, 77, 78 and 79, each ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 69, $40\frac{81}{100}$ CHAINS.					
43	Phelps' farm bridge (on bents)	.....	Wood	52	1	....
	Lock No. 80, nine-feet lift, southward	.....	.....	......	....	.....

TABLE No. 4—*Showing the length of the levels on the Black river canal, and the structures on each in their order*—(Continued).

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	LEVEL No. 70, $16\frac{16}{100}$ CHAINS.					
	Locks Nos. 81, 82, 83 and 84, each nine-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 71, $45\frac{97}{100}$ CHAINS.					
	Aqueduct No. 5 (Sugar river), stone abutments and piers, wood trunk, three spans, forty feet each, pier five feet eleven inches wide	.....	.....	......	....	.....
44	Road bridge	Iron.	.....	52	1	.....
	Lock No. 85, ten-feet lift, southward	.....	.....	.....	....	.....
	LEVEL No. 72, $20\frac{20}{100}$ CHAINS.					
45	Farm bridge (on bents)	.....	Wood	52	1	.....
	Lock No. 86, eleven and one-half feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 73, $19\frac{19}{100}$ CHAINS.					
	Locks Nos. 87, 88, 89, 90, each ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 74, $13\frac{18}{100}$ CHAINS.					
46	Farm bridge (on bents)	.....	Wood	52	1	.....
	Lock No. 91, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 75, $108\frac{83}{100}$ CHAINS.					
47	Farm bridge (on bents)	.....	Wood	52	1	.....
48	Farm bridge (on bents)	.....	Wood	52	1	.....

49	Farm bridge (on bents)	.....	Wood	52	1	.....
	Lock No. 92, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 76, $36\frac{2}{100}$ CHAINS.					
50	Farm bridge (on bents)	.....	Wood	52	1	.....
51	Farm bridge (on bents)	.....	Wood	52	1	.....
	Lock No. 93, ten-feet lift, southward	....	.....	......	....	.....
	LEVEL No. 77, $28\frac{50}{100}$ CHAINS.					
52	Farm bridge (on bents)	.....	Wood	52	1	.....
	Lock No. 94, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 78, $96\frac{96}{100}$ CHAINS.					
	Bulkhead and spellway No. 7 (stone abutments)	.....	.....	......	....	.....
	Culvert No. 7, arch	.....	.....	......	....	.....
53	Farm bridge (on bents)	.....	Wood	52	1	.....
54	Farm bridge (on bents)	.....	Wood	52	1	.....
55	Main street bridge (Port Leyden)	Iron.	.....	56	1	2
56	Second street bridge (on cribs)	.....	Wood	64	1	.....
	Gere's crossing to his iron-works, private swing	.....	.....	......	....	.....
	Culvert No. 8, box	.....	.....	......	....	.....
	Lock No. 95, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 79, $27\frac{97}{100}$ CHAINS.					
	Culvert No. 9, arch	.....	.....	......	....	.....
	Lock No. 96, ten-feet lift, southward	.....	.....	......	....	.....
	LEVEL No. 80, $14\frac{2}{100}$ CHAINS.					
	Lock No. 97, ten-feet lift, southward	.....	.....	......	....	.....

TABLE No. 4.—*Showing the length of the levels on the Black River canal, and the structures on each in their order*—(Continued).

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	LEVEL No. 81, 18$\frac{98}{100}$ CHAINS.					
	Culvert No. 10, arch					
57	Change bridge (stone abutments)		Wood	52	1	
	Lock No. 98, ten-feet lift, southward					
	LEVEL No. 82, 39$\frac{20}{100}$ CHAINS.					
58	Road bridge (stone abutments)		Wood	52	1	
	Locks Nos. 99 and 100, each ten-feet lift, southward					
	Lock No. 101, ten and one-half-feet lift, southward					
	LEVEL No. 83, 11$\frac{4}{100}$ CHAINS.					
59	Farm bridge (on bents)		Wood	52	1	
	Lock No. 102, ten and one-quarter-feet lift, southward					
	LEVEL No. 84, 82$\frac{32}{100}$ CHAINS.					
	This is the river level above Lyons Falls dam; towing-path follows the west bank for a distance of 44$\frac{17}{100}$ chains to the side-cut around the falls					
60	Road and change bridge over the side-cut; has stone abutments		Wood	50	1	
	Lock No. 103, four-feet lift, southward, and locks Nos. 104 and 105, each ten-feet lift, southward					

	LEVEL No. 85, $17\frac{60}{100}$ CHAINS.					
61	Road bridge, Lyons Falls, stone abutments	Iron.	.....	52	1	1
	Locks Nos. 106 and 107, eleven-feet lift southward	.....	.....	......	....	.....
	LEVEL No. 86, $10\frac{10}{100}$ CHAINS.					
	Spillway No. 9, on tow-path side	.....	.....	......	....	.....
62	Road bridge (on bents)	.....	Wood	52	1	.....
	Locks Nos. 108 and 109, each twelve-feet lift southward	.....	.....	......	....	.....
	Dam at Lyons Falls, 491 feet long, built of timber, with stone abutments	.....	.....	......	....	.....
	Bridges over Black and Moose rivers, at their junction just above dam.	.....	.....	......	....	.....
	Black river bridge has two spans of ninety-feet each and seventeen-feet roadway	.....	.....	......	....	.....
	Moose river bridge has one span of ninety feet and one span of ninety-one-feet and seventeen-feet roadway. The two bridges have stone abutments and piers	.....	.....	......	....	.....

TABLE No. 4 — *Black River feeder, from Boonville to Forestport, is* $10\frac{10}{100}$ *miles long.*

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	The structures are as follows:					
1	Farm bridge, truss on bents	....	Wood	52	1	.....
2	Road bridge, truss on bents	....	Wood	52	1	.....
	Bulkhead No. 1, and spillway connected, tow-path side	....	.....	......	....	.....
3	Farm bridge, truss on bents	....	Wood	52	1	.....
4	Road bridge, truss on bents	....	Wood	52	1	.....
5	Farm bridge, truss on bents	....	Wood	52	1	.....
6	Road bridge, truss on bents	....	Wood	52	1	.....
7	Road bridge, truss on bents	....	Wood	52	1	.....
	Culvert No. 1	....	.....	......	....	.....
8	Farm bridge, truss on bents	....	Wood	52	1	.....
	Bulkhead No. 2, on berme side	....	.....	......	....	.....
	Culvert No. 2	....	.....	......	....	.....
9	Road bridge, truss on bents	....	Wood	52	1	.....
10	Road bridge, truss on bents	....	Wood	52	1	.....
	Culvert No. 3	....	.....	......	....	.....
11	Road bridge, truss on bents	....	Wood	52	1	.....
	Bulkhead No. 3, near Forestport, tow-path side	....	.....	......	....	.....
12	Road bridge, truss on bents	....	Wood	52	1	.....
	Guard-lock at entrance into the pond	....	.....	......	....	.....
13	Road bridge, truss on bents, crosses directly over the locks	....	Wood	52	1	.....

Forestport dam is located seven chains north of the lock; is of timber with stone abutments and one pier. The dam is in two sections, one 172 feet long and one forty feet long, making spillway of 212 feet in length, pond about two miles long.

TABLE No. 4—*Delta feeder, taken into canal seventy-five feet north of Mohawk aqueduct, total length* 106$\frac{29}{100}$ *chains.*

Number of bridge.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	The structures are:					
1	Stringer bridge at the mouth of feeder, sixteen-feet span, twelve feet wide	....	Wood	16	1	.....
2	Farm bridge, truss on bents	....	Wood	40	1	.....
3	Farm bridge, truss on bents	....	Wood	40	1	.....
4	Stringer bridge, just below the lock, sixteen-feet span, twelve feet wide	....	Wood	16	1	.....
	Guard and lift-lock at the head of feeder (stone)	....	.....	......	....	.....
	Dam across the Mohawk river, located 5$\frac{50}{100}$ chains from the lock, is 234 feet long — feet high	....	.....	......	....	.....

Table showing the length of the levels on the Oneida Lake canal and structures on each in their order, with the distances between them, as follows: (Junction with the Erie canal at Durhamville).

LEVEL No. 1, 154$\frac{46}{100}$ CHAINS.

Number of bridge.	Distances in chains.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
	.....	Tumble gate	.....	.....	.....	....	.....
1	28.06	Farm bridge	.....	Wood	71	1	.....
	27.34	Culvert No. 1	.....	.....	.....	....	.....
2	17.31	Road bridge	.....	Wood	75	1	.....
	81.75	Lock No. 1 (stone with fenders), eleven-feet lift, going south	.....	.....	.....	....	.....
		LEVEL No. 2, 193$\frac{29}{100}$ CHAINS.					
3	3.00	Road bridge	.....	Wood	72	1	.....
	35.20	Culvert No. 2	.....	.....	.....	....	.....
4	12.80	Road bridge	.....	Wood	75	1	.....
	20.22	Culvert No. 3	.....	.....	.....	....	.....
5	6.13	Road bridge	.....	Wood	71	1	.....
	115.94	Lock No. 2 (stone fenders), ten-feet lift, going south	.....	.....	.....	....	.....
		LEVEL No. 3, 13$\frac{60}{100}$ CHAINS.					
	13.60	Lock No. 3 (stone with fenders), ten-feet lift, going south	.....	.....	.....	....	.....
		LEVEL No. 4, 29$\frac{76}{100}$ CHAINS.					
6	2.50	Road bridge	.....	Wood	71	1	.....
	10.25	Culvert No. 4	.....	.....	.....	....	.....
	26.31	Lock No. 4 (stone with fenders), ten-feet left, going south	.....	.....	.....	....	.....

		LEVEL No. 5, $9\frac{50}{100}$ CHAINS.					
7	5.39	Old State road bridge	.....	Wood	$73\frac{8}{12}$	1	.....
	4.11	Lock No. 5 (stone with fenders), ten-feet lift, going south	.....	.....	......	....	.....
		LEVEL No. 6, $6\frac{30}{100}$ CHAINS.					
		Lock No. 6 (stone with fenders), eleven-feet lift, going south	.....	.....	......	....	.....
		ONEIDA LAKE LEVEL.					
		Docking, nine chains long	.....	.....	......	....	.....

Table showing the length of the levels on the Oneida Lake canal and structures on each in their order, with the distances between them, as follows: (Junction with the Erie canal at Durhamville).

Number of bridge.	Distances in chains.	GENERAL DESCRIPTION.	Arch truss.	Trapezoidal truss.	Span of bridge.	Number of roadways.	Number of sidewalks.
		LEVEL No. 1, 154$\frac{46}{100}$ CHAINS.					
		Tumble gate					
1	28.06	Farm bridge		Wood	71	1	
	27.34	Culvert No. 1					
2	17.31	Road bridge		Wood	75	1	
	81.75	Lock No. 1 (stone with fenders), eleven-feet lift, going south					
		LEVEL No. 2, 193$\frac{29}{100}$ CHAINS.					
3	3.00	Road bridge		Wood	72	1	
	35.20	Culvert No. 2					
4	12.80	Road bridge		Wood	75	1	
	20.22	Culvert No. 3					
5	6.13	Road bridge		Wood	71	1	
	115.94	Lock No. 2 (stone fenders), ten-feet lift, going south					
		LEVEL No. 3, 13$\frac{60}{100}$ CHAINS.					
	13.60	Lock No. 3 (stone with fenders), ten-feet lift, going south					
		LEVEL No. 4, 29$\frac{76}{100}$ CHAINS.					
6	2.50	Road bridge		Wood	71	1	
	10.25	Culvert No. 4					
	26.31	Lock No. 4 (stone with fenders), ten-feet left, going south					

		LEVEL No. 5, $9\frac{50}{100}$ CHAINS.					
7	5.39	Old State road bridge	.....	Wood	$73\frac{8}{12}$	1	.....
	4.11	Lock No. 5 (stone with fenders), ten-feet lift, going south	.....	.....	......	....	.....
		LEVEL No. 6, $6\frac{30}{100}$ CHAINS.					
		Lock No. 6 (stone with fenders), eleven-feet lift, going south	.....	.....	......	....	.....
		ONEIDA LAKE LEVEL.					
		Docking, nine chains long	.....	.....	......	....	.....

NEW YORK STATE CANALS,

WESTERN DIVISION.

REPORT OF THOMAS EVERSHED,

DIVISION ENGINEER

FOR THE

YEAR ENDING SEPTEMBER 30, 1888.

WESTERN DIVISION.

ANNUAL REPORT OF THOMAS EVERSHED, DIVISION ENGINEER, FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1888.

ROCHESTER, N. Y., *October* 4, 1888.

Hon. JOHN BOGART, *State Engineer and Surveyor:*

SIR. — I have the honor of submitting to you the following, being my report on the western division of the State canals for the fiscal year ending September 30, 1888:

The canals, slips and navigable feeders are as follows:

	Miles.
Erie canal from the east line of Wayne county to Hamburg street, Buffalo	148 92
Five slips in the city of Buffalo aggregate length	1 60
Genesee River feeder in the city of Rochester	2 25
Total miles	152 77

UNNAVIGABLE FEEDERS.

Tonawanda and Oak Orchard creeks	11 55
Genesee Valley canal, from Cuba reservoir to lock No. 87, Rockville	7 65
Genesee Valley canal, from Scottsville to Rochester	11 00
Total miles	30 20

The sources of water supply for the Erie canal are as follows:

1. Lake Erie, at Buffalo.
2. Tonawanda creek, at Pendleton
3. Tonawanda and Oak Orchard Creek feeder, at Medina.
4. Allen's creek, through the Genesee Valley canal, from Scottsville to Rochester.
5. The Cuba reservoir, in Allegany county, through the Genesee Valley canal and the Genesee river to Rochester, and through the Genesee River feeder, in the city of Rochester, into the canal.

The chief source of supply, however, is from Lake Erie, which may be said to supply the whole division, as the flow of water is toward the east.

The Tonawanda and Oak Orchard feeder, as well as the Genesee river, materially assist in filling the canal in the spring. During the hot-dry weather in the summer the supply is also supplemented by the Cuba reservoir and Allen's creek; the reservoir will afford 4,000 cubic feet per minute for the three months during which it is drawn on to help supply the canal.

Of late years but little difficulty has been experienced in keeping up the different levels to full canal height when care has been taken to use as little water as possible in locking boats on the locks east of and at Newark.

DAMS.

There are six dams on the division, as follows:

1. One across Tonawanda creek near its mouth; it raises the water in the creek about four feet above the level of Niagara river.
2. One across the same creek south of Medina. Its purpose is to turn the water of the creek into the feeder, and through it into the channel of Oak Orchard creek, and from thence into the canal at Medina.
3. One across Allen's creek, in the village of Scottsville, to send the water through the Genesee Valley canal, which is now used as a feeder from Scottsville to Rochester.
4. One across the Genesee river, in Rochester, to turn the water of that stream into the feeder.
5. One across Oil creek, near the village of Cuba, to hold the water of that creek and form a reservoir. It is of earth, faced with rip-rap and slope wall; it is 2,200 feet long and sixty-five feet in height where it crosses the stream.
6. One across a valley two miles from the last-mentioned one. It has a waste-weir to serve as an escape for the water of the creek when the reservoir is full.

Repairs are now needed on the one at Rochester, the wood-work of which requires to be renewed almost entirely.

ROCHESTER FEEDER.

This feeder, as before stated, is two miles and a quarter in length, it is in fair condition, except, that to make it secure from floods, the bank between it and the river should be raised three feet. During the last year a railroad company applied to the Superintendent of Public Works for the right to use this bank for their track, which was granted with the provision that the bank should be so raised as one of the considerations for the privilege.

The bulkhead and gates at the upper end require to be new wooded.

LOCKS.

There are twenty-three locks in this disivion; they all lock down toward tide-water with various lifts as follows:

No.	Location.	Lift in feet.
53.	One and one-fourth miles west of Clyde	4.755
54.	At lock Berlin	7.360
55.	In the village of Lyons	6.251
56.	Poor-house one and one tenth miles west of Lyons	9.848
57.	In the village of Newark	8.028
58.	In the village of Newark	8.004
59.	In the village of Newark	8.002
60.	Eight-tenths of a mile east of Macedon	9.886
61.	In village of Macedon	6.601
62.	Two and a quarter miles west of Pittsford	8.807
63.	Miller's, in the village of Brighton	8.719
64.	Sipple's, in the village of Brighton	10.108
65.	Reservoir in the city of Rochester	10.102
66.	First lock in the city of Rochester	8.859
67–71.	Five double combined locks at Lockport	57.427
	One guard-lock at Sulphur Springs. It has one chamber 110 by twenty feet, and two additional head-gates. It is used when there is a flood in the creek, other wise, it stands open.	
	One river lock at Tonawanda connecting the Niagara river with the canal, the lift is generally four feet, depending on the height of the water in the river.	
	One double chambered guard and lift-lock at Black Rock (No. 72); it is 112 by twenty feet. The lift, together with the fall in the harbor from the canal below the mean low water in the lake, is	2.425
	Total lift	175.182

By adding to the lift of the locks, the surface-descent on the different levels, we get the total descent on the division.

On Montezuma level	.196
On Twelve-mile level, lock No. 59 to No. 60	.165
On Seventeen-mile level, lock No. 61 to No. 62	.343

On Three-mile level, lock No. 62 to No. 63	.063
On Long level, Rochester to Lockport	3.165
On level between Lockport and Black Rock	1.239
Total rise going west	180.353

There is, also, one single-chambered slip-lock, from Black Rock harbor into the Niagara river; it is 200 by thirty-six feet, the lift is unusally four feet, according to the height of the water in the lake and river.

Also, one weigh-lock in the city of Rochester, not now used as such.

Lengthening the Locks.

By act 113, Laws of 1887, the Superintendent of Public Works was authorized to double the length of a number of locks on the Erie canal. Under it, one each of the double locks, Nos. 53, 54, 56, 60, 61 and 62 were lengthened at the foot, and No. 55 at the head; the lengthened parts were made 111 feet long and twenty feet wide, thus allowing the boats to enter freely by reason of the two feet extra width; a great improvement, as well as that of lowering the walls of lock No. 61 Upper Macedon.

By act 463, Laws of 1887, No. 72, the guard-lock at Black Rock was likewise lengthened at the foot; it was made 112 feet longer and twenty feet wide.

They were all finished in time for the opening of navigation in the spring of 1888.

By act, chapter 416, Laws of 1888, two more locks (Nos. 63 and 64) on this division are to be lengthened at the foot.

The work has been let, and the contractor is delivering the materials therefor.

Repairs of Locks.

Repairs were made to gates on all the locks on Sections 8 and 9, and the Lockport locks.

Repairs to miter-sills in locks Nos. 53, 57, 59 and 61.

New gates were inserted as follows: One in No. 54, one No. 59, two pair in No. 61, one pair in Lockport locks, one pair in Sulphur Spring guard-lock.

New miter-sills were put into locks Nos. 53, 58 and 61.

New miter-sill platforms were put into locks Nos. 58 and 60, the latter being a tumble-gate platform.

Forty new paddles were inserted in the gates from lock No. 53 to No. 66.

New balance-beams were placed on different lock-gates where needed.

The following locks were replanked in part: Nos. 56, 58 and the Lockport locks, where it was needed.

REPAIRS TO LOCKS NEEDED.

Repairs to gates, locks 53 and 54.

New gates are required in locks, 58, one pair; 61, one pair; 64, one pair; 65, one pair; Sulphur Spring guard-lock, two pairs; ship-lock, Black Rock, two pairs.

New tumble-gates at the head of locks 55, 60 and 64.

New tumble-gate platforms at locks 54, 62, 63, 64, 65 and 66.

New paddles in locks, 53, eight; 56, eight; 57, four; 62 to 66, about twenty.

New miter-sills, locks 53, 57, 58 and 61.

New balance-beams, lock 53, one; 55, one; 57, one; 59, one; 61, two; 65, one.

New lining in locks 54, 58 and 59.

New crib, upper end of lock 61.

Bills of timber have been made out for the above new work.

In the Lockport locks, the upper lock (No. 71), on the berme side, has been narrowed up, by the action of the frost and ice in the raceway, immediately in the rear of the wall, so that there is difficulty in locking through some of the largest boats; the wall should be dressed off so as to widen the lock, and the hollow quoins should be dressed out so as to let the gate back to effect the same object.

Bills of timber have been made out and given to the Assistant Superintendent of Public Works for the purpose of lengthening the pier at the head of these locks.

The masonry of the ship-lock, at Black Rock, has been much damaged by the striking of the heavy vessels which pass through it; a list of the stone required for its repair has been handed to the Assistant Superintendent of Public Works.

The coping on the river-lock, at Tonawanda, has been badly split up by the action of fire a few years ago, when the adjoining wooden buildings were destroyed. I would mention that suitable coping can be procured from a lock, belonging to the State, on the Genesee Valley canal, about six miles south of Rochester.

AQUEDUCTS.

There are four aqueducts on this division as follows:

LOCATION.	Total length, in feet.	Number of spans.	Span, in feet.	Height to coping from stream, ft.	Character of trunk.	Width of water-way, in feet.	Depth of water, in feet.	When built.	Original cost.
Lyons	130	5	20	18	Wood	50	7	1848	$42,106 18
Palmyra	94	3	24	19	Wood	50	7.20	1857	34,423 36
Rochester	800	2	25	27	Stone	43	7.67	1842	445,387 00
Rochester	....	7	52	....	......	....	....	....	....
Rochester	....	1	30	....	......	....	....	....	....
Medina	.80	1	53	35	Stone	85	820	1855	50,811 00

In the aqueduct at Palmyra the timbers are badly decayed; they should be renewed wholly or in part.

On the twentieth of May, of this year, a bad leak occurred behind the east abutment, it was stopped, with difficulty, after filling in several boat-loads of gravel mixed with cement.

On the west side a piece of vertical wall should be erected to guard against leaks.

The aqueduct at Rochester, had originally a lining of plank in the bottom, it was taken out a number of years ago and a coating of tar substituted therefor; this had disappeared several years ago; it should have the joints cleaned out, caulked and a coating of Portland cement spread over it, as it leaks badly, and the action of the severe frosts, of this climate, is damaging the structure. This can, also, be said of the aqueduct at Medina; the earth should be removed on the towing-path side and the masonry pointed up and grouted, and the earth puddled back again as before.

BRIDGES.

There are forty-three wooden road or farm bridges, twenty of wood with lower cords of iron, and 157 entirely of iron, 220 in all, over the Erie canal, slips in Buffalo and elsewhere, being one more than in my last report. There have been two new road-bridges constructed during the last fiscal year, but, as the city of Rochester has erected a lift-bridge at Plymouth avenue, there is only an additional one to the total number belonging to the State.

There are thirty-one bridges belonging to different railroad companies over the Erie canal and the slips appertaining to it.

There are four lift-bridges belonging to the city of Rochester.

Also, two road-bridges belonging to the city of Buffalo, and one iron bridge belonging to a private individual.

There are, also, five iron road-bridges over the State ditch, in Tonawanda; one near the Sulphur Spring guard-lock, also, over a State ditch; one over the old canal, at Knappville, and one over the Oak Orchard feeder, at the Batavia road.

There are, also, fifty-one wooden road and farm-bridges over the State ditches in Erie and Niagara counties; one of these, at Goundry street, North Tonawanda, is to be replaced by a rubble arch-culvert, an appropriation having been made by the last Legislature; the work has been let; it will be completed this fall.

Two out of three wooden truss-bridges over the State ditch, in South Tonawanda, built and hitherto kept up the State, are, also, to be replaced by arch-culverts; the work has been let, and construction commenced under act of the last Legislature.

Wooden-bridge, No. 143, has been renewed during the last fiscal year.

Wooden-bridge, No. 45, has been replaced by one of iron; this formerly stood on wooden bents; substantial stone abutments were constructed at this point, last spring.

No. 75, iron, at Plymouth avenue, in the city of Rochester, was replaced by a lift-bridge, built, and to be operated at the expense of the city.

No. 91 Main street, Brockport, was taken down and replaced by a lift-bridge under special act of the Legislature. It consisted of three trusses. With the addition of one new truss, these will make two new iron bridges which may be used where wooden bridges now exist either at Cromwell's highway (No. 95) four miles grocery (No. 89) or Webster's west highway (No. 101).

The iron bridge at Glasgow street, Clyde (No. 4), has been taken down and a lift-bridge put up in its place, the old superstructure will fit the abutment at Waldruff's highway (No. 3) the wooden bridge at which place will require renewal very shortly.

The iron bridge at Main street, Tonawanda (No. 177) has been replaced by one of wrought-iron twenty-nine feet from center to center of trusses, with two sidewalks, one of ten and the other of six feet in width. The old superstructure will not fit any abutments on this division.

Two new iron bridges have been built in the city of Buffalo, by special act of the Legislature, one at Hudson street and one at Austin street, both of these bridges open up new territory between the canal and the river.

The necessary amount of repairs have been given the roadways of bridges.

The south abutment of the towing-path bridge over the Tonawanda creek at Pendleton, which had long been gradually giving way towards the creek, owing to a settlement of the foundation, was taken down and rebuilt in a substantial manner last spring.

The swing-bridge over the Ohio slip at Ohio street in Buffalo, which had long been in a very bad condition, so that it was almost impossible to work the draw, was last spring entirely removed from its position, a pile foundation was given the center pier, which was rebuilt, new track substituted for the old one, the bridge may now be said to be in good shape for a structure which has often been struck both by vessels and cars. It can be operated with ease.

Wooden bridges Nos. 62 and 104 will have to be replaced by others during the next fiscal year.

The swing-bridge at West Main street in the city of Rochester will be replaced by a lift-bridge during the next winter, as per act chapter 351, Laws of 1888.

The present iron bridge at Geneva street in the village of Lyons will also be replaced by a lift-bridge, act chapter 546, Laws 1888.

An iron superstructure, Swart's plan, fifty-four feet six inch span, two roadways lie in the State yard, Buffalo, it was intended to use it over the State ditch in South Tonawanda, now that culverts are to be constructed there it will not be wanted, and might be of use on one of the lateral canals.

An iron swing-bridge, twenty-four feet six inches span, ten feet six inches width of roadway, is in the State yard, in Rochester, it was used for tow-path crossing of a slip in the city of Rochester, it might be made use of again for a similar purpose.

A number of bridges on the division are too low; they should be raised; they are No. 18, Lyons; No. 30, Port Gibson; Elk street, on Clark and Skinner canal, belonging to the State, and one on slip No. 1, belonging to the New York Central railroad, and one over the same slip, belonging to the city of Buffalo.

I append hereto a list of all the bridges on the canal and slips in Buffalo, showing their height above mean low water in the lake.

REPAIRS OF MASONRY OF BRIDGES.

On the abutments of thirteen of the bridges on this division, repairs should be made before the letting in of the water in the spring.

On sixty-seven, stone are missing.

On twenty, the coping and facestone need replacing.

A number of bridges require the masonry of both abutments and wings raised to retain the earth properly.

A list of stone and their sizes has been furnished to the Assistant Superintendent of Public Works.

At exposed points the berme abutments have been damaged by boats striking them during the prevalence of heavy winds; they should have piles driven in front of them, or wooden piers filled with stone placed at the ends of the wings.

CULVERTS.

There are 136 culverts on this division.

The large arch culvert at Irondequoit creek has had a double row of piles driven across the north end of the foundation and extending into the banks on each side; the space between them was filled with concrete; this was done to prevent the water which, percolating from the canal above, issued out below the foundation timbers; it has been found to answer the purpose intended.

The two box-culverts at Cornelius creek, Buffalo, and at the State ditch at Tonawanda, have been cleaned out and the wings at each end thoroughly repaired.

The culvert at Fish creek which last year leaked badly was stripped last spring and grouted up.

No. 36, at Donnely's farm on three mile level, which has been composed of two wooden trunks and two cast-iron pipes, has had the ends of the two wooden trunks stopped up with masonry, as a precautionary measure against a break; as the timber is much decayed, I would recommend that they be taken out entirely and pipes of cast-iron inserted instead.

A small stone-culvert under the Genesee River feeder should have a wooden trunk, as the stone one is constantly leaking.

A bill was passed, last winter, to lower a culvert near Rowe street, in the city of Rochester; this is rendered necessary by the fact that the city has extended so as to cover the ground drained by it, it is to be doubled in capacity, and will then have two iron pipes of two feet in diameter.

On the seventh of July, last, a break occurred at Adams basin, which carried away the south end of the double-arch culvert and the waste-weir gates which were attached to it, as well as about fifty feet of the bank; to close the gap thus made in the most expeditious manner, a crib of timber was made eighty feet in length, twenty feet in height and sixteen feet wide, this was filled with earth, the front was sheet piled and a bank made to connect it with the original bank. It will, probably, stand for some time, but it should be restored to its former usefulness as a waste-weir as well as culvert. I would recommend that the end of the culvert be constructed with its wings, waste-weir and gates complete, a few feet south of the present end, and during the summer, then the junction of the two portions of the culvert, as well as the connections with the old banks on each side, could be made during the spring following.

As with the bridges, I have had a list made of the number of new stone required and their size, which will be required to put the culverts in good repair; the parapets and wings have been much displaced by frost. I would recommend, after they are rebuilt, that about two feet in thickness of field-stone be placed behind them to prevent the recurrence of this displacement.

Stone are gone from forty of these structures, and on fifty-one the parapets and wings should be relaid.

All require to be pointed up.

WASTE-WEIRS.

There are twenty-four waste-weirs on this division.

The one at Brockport was retimbered last spring, and the one at Cartersville replanked.

Those at Middleport, Albion, and on three-mile level should have the timber work renewed before another season's navigation.

The waste-weir at Cartersville should have an apron of rubble masonry built below the present wooden foundation, to keep the latter wet at all times, and thus prevent decay.

The waste-weir at Adams basin should be restored as soon as convenient, as there is now but one gate (at Spencerport) between Rochester and Brockport (twenty miles), a distance altogether too great to be without the means of discharge in case it is found to be expedient to draw off the water from the canal quickly, besides the natural stream below Brockport is quite small and closely built upon, so that the opening of those three gates under a full head of water would, I have no doubt, be attended with much damage to property below.

STOP-GATES.

There are six stop-gates on this division, as follows;

STOP-GATES.

LOCATION.	Width of water-way —Feet.	Number of gates.	Kind of gates.	For protection of bank.	Facing towards the—	Distance protected—Miles.	Original cost.
Bushnell basin.... ...	40.½	1........	Tumble .	Irondequoit bank ...	East.........	....	$4,046 53
Cartersville	41	1........	Tumble .	Irondequoit bank ...	West	1.60	5,734 38
Adams basin	41	2 pairs ..	Miter....	High bank	East and west.	13.09	8,283 40
Holley, east	39.6	1 pair ...	Miter.....	Holley bank.......	East.........	10.17	2,998 07
Holley, west..........	40.6	1........	Tumble .	Holley bank........	West	2.23	4,365 00
Medina	40	1........	Tumble .	Road culvert	West	18.21	5,557 14

All of these structures require to be thoroughly repaired. The use made of the one at Adams basin during the repairing of the break this summer, showed the benefit to be derived from these structures in case of breaks.

The masonry in the center piers is light, and they have had many years of hard usage from being struck by boats, besides the usual action of the elements; some of them should be taken down and rebuilt wholly or in part, notably those at Holley Adams basin and the road culvert.

VERTICAL WALLS.

The length of time which has elapsed since these walls were built has, by the decay of the material in some cases together with the action of the frost, so displaced them that frequent slides occur. This is particularly so in the city of Rochester, in Albion and other villages west of Rochester, and is made worse from the fact that there was no good gravel to put behind them. In Rochester about five hundred feet in length was relaid last spring, which should be continued until the whole is relaid. I would mention that good stone can be procured for this purpose from the bed of the Genesee river, on State property, just below the acqueduct. In Buffalo the walls on the division pier, between the harbor and the canal, have been repaired and new docking placed thereon. A piece of wall was taken down and rebuilt in a substantial manner on the corner of Commercial slip and the Erie canal in Buffalo.

About fifty feet in length on the berme side of the canal on the west side of the aqueduct at Palmyra is much needed.

A slide which occured on the berme side of the canal at Tonawanda last fall was repaired last spring.

About one hundred feet in length on the towing-path side under the new bridge at Main street in the same village was constructed on a suitable foundation of piles, a thing much needed for many years.

A piece of docking having become decayed has fallen down between the change bridge at Pendleton and the towing-path bridge over the creek. A distance of about one hundred feet should have a vertical wall to replace the temporary wooden structure now there.

SLOPE WALLS.

The slope walls east of Rochester, owing to the nature of the soil being of a gravelly character are in good repair, but west of that city the soil changes and is composed for the most part of a mixture of clay and quicksand and the frost has heaved them out of shape.

SHEET PILING.

The sheet piling for fifty feet on each side of the culvert at Irondequoit was taken up last spring, longer plank substituted, and the bottom of the canal puddled afresh to stop the percolation of water into the culvert below, to the foundation of which it was doing considerable damage. This should be continued for 100 feet further on each side, and as by reason of long-continued throwing-in of sand to stop filtration, the prism of the canal has become a good deal lessened in size, this might be continued the whole length of the embankment. This has been done at Bushnell's basin, and that embankment, from being the most dangerous piece of canal on the division, may now be considered quite safe from any mishap.

CANAL BANKS.

Considerable attention has been paid to raising the banks and strengthening the same, so as to sustain a greater depth of water, notably below Lockport, for some miles between Pittsford lock and the village of that name.

The Montezuma level should be made to carry six inches more water; this would save cleaning out the canal, and, at the same time, give six inches more water on the miter-sill at the Port Byron lock, a thing much to be desired; this can only be accomplished by raising the banks.

The level between lock 55, Lyons, and 56, poor-house, might be raised to good advantage six inches; this would reduce the amount of water used at the high-lift lock, No. 56, and lessen the amount required on the lower end of the division.

The raising the towing-path on Tonawanda creek has been continued; where completed, it has received a coating of cinders or gravel; this raising the bank and rip-rapping the face of the towing-path, now nearly or quite completed, is a marked improvement.

PRISM OF THE CANAL.

In my former reports I have mentioned the large amount of silty matter which has accumulated in the canal on this division. This has chiefly been deposited on the berme side, where the action of passing steamers does not disturb its deposit. I have recommended the use of dredges for its removal.

An appropriation was made last winter for "deepening and bottoming out said Erie canal to its original standard depth."

A party of engineers have been employed, during the last two months, sounding the canal to determine the amount of work to be done to accomplish this on the Seventeen-mile level and on the Long level between Rochester and Lockport.

As this work of bottoming out the canal to its original depth can not be done in the exact manner prescribed by the law by dredging, it must be accomplished by hand-labor during the winter months; a laborious and expensive way of accomplishing the work.

Instead of this, I would recommend on the Seventeen-mile level, where the accumulation is but slight, that a dredge be used, keeping in the center of the canal and taking out a good bucket-full in such a way as not to endanger the slope-wall; the material being of a quicksand character would soon assume a smooth shape leaving a good depth of water in the center of the canal for the passage of boats; this could be continued from the lower end, at Macedon, up as far as Bushnell's basin embankment, skipping, of course, where culverts are near the bottom, and where lining has been resorted to to render the bottom impervious to leakage; above that point to the lock above Pittsford, the result can be better accomplished by raising the banks and the water-surface.

On the Long level, between Rochester and Lockport, the same course could be adopted where the bottom is of earth, and, as the volume of silty matter is much greater, a good portion of that could be removed without endangering the slope walls.

Where the bottom is of rock, a good portion of the silt could, in like manner, be removed with the dredge and the rest by hand-labor.

On the Seventeen-mile level the work could be done in the usual manner, with dump-scows, as the material could be deposited in the deep water at the " Ox-bow," but on the Long level it would be disposed of as described in my report of last year, viz. : Dumped into boxes on scows by the dredge, and those emptied over the bank by means of steam-derrick.

I append a list of the distances where the bottom of the canal is composed of earth and rock on the Long level, between Rochester and Lockport.

The usual amount of work was expended in cleaning out the canal in the spring, it was thoroughly done between the village of Pittsford and the lock above, to facilitate the passage of the water to the narrow canal at the Irondequoit embankment below.

SEA WALL, BUFFALO.

No repairs have been made on this during the fiscal year.

BIRD ISLAND PIER.

A large amount of work is needed to put this important structure in repair from the ravages occasioned by the grinding of the ice of the last few winters.

ERIE BASIN BREAKWATER.

No repairs have been made on this structure during the last fiscal year, as it is in good condition.

SEWERS IN BUFFALO.

There is still a large amount of territory, the sewage from which should be conducted into the trunk-sewer, which must be done by pumping, to relieve the Hamburg canal from its filthy condition, viz., all that portion of the city which lies between that canal and the harbor. There are a number of factories in this district which should be made to pump their refuse across the Hamburg canal so that it would enter sewers on the other side leading to the trunk-sewer. This is particularly the case with the grape sugar works.

There is, also, a portion of the city lying between the trunk-sewer, on Swan street, and the Hamburg canal, which empties its sewage into the latter. This should be remedied.

Since my last report the city has completed the four-feet sewer leading from the Bird Avenue sewer to the trunk-sewer at Albany street.

The large sewer (Hertel avenue), which will empty the whole of its contents into the river through the Cornelius Creek culvert, is approaching completion.

The finishing of these two last-mentioned sewers will relieve the canal from the dry-weather flow of the whole city, with the exceptions mentioned above.

The city of Locksport empties all, and the city of Rochester a part of its sewage into the canal; the latter city is making preparations to relieve it from this evil.

DREDGING IN THE HARBOR AND BASINS OF BUFFALO.

An appropriation of $30,000 has been expended, this summer, on these appendages of the Erie canal; quite outside of this department, however.

DEEPENING THE CHANNEL OF OAK ORCHARD FEEDER.

A partial expenditure of an appropriation of $25,000 on this work has been made, also, entirely separate from supervision of the Division and Resident Engineers.

NAVIGATION.

On the seventh of July a break occurred at Adams basin, carrying away the south end of the culvert and destroying the waste-weir which occupied the head of the same; it also cut out about fifty feet of the bank. It was repaired in a temporary manner by constructing a crib-work filled in with earth across the opening. Navigation was detained twelve days.

On July twenty-seventh a break occurred in the berme bank on the Three-mile level carrying away about thirty feet of bank by which navigation was suspended twenty-four hours.

Other than these there has been no detention to navigation during the season up to the present time.

ENGINEERING.

This division has been under the charge of Thomas Evershed as division engineer and John Bisgood as resident engineer.

The large number of structures built during the last fiscal year has required constant attention from the engineer force which was largely increased to meet it. The additional force has been reduced again to suit the reduced amount of work to be done the next winter.

Surveys have been made of the lands overflowed and notes taken of the damage done to the crops below the two breaks before mentioned. In one case the survey extended for a distance of twelve miles from the place at which the break occurred.

Several other surveys have been made for the Board of Claims, all of which consumed time of the assistant engineers.

Respectfully submitted.

THOS. EVERSHED,

Division Engineer.

Statement giving names, rank, number of days and compensation of engineers upon the repairs of the Western Division of the New York State canals, with incidental expenses during the fiscal year ending September 30, 1888, *from October* 1, 1887, *to September* 30, 1888.

ORDINARY REPAIRS — ERIE CANAL.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
Thomas Evershed	Division engineer	Salary	$2,400 per year.....	$2,400 00
Thomas Evershed ...	Division engineer	Expenses.	....	381 19
John Bisgood..........	Resident engineer....	¼ of year.	$2,000 per year.....	500 00
John Bisgood..........	Resident engineer....	Expenses..	....	121 42
John Bisgood..........	Resident engineer....	36 days.....	$2,000 per year.....	230 04
Charles Szen	Asst. eng'r in charge.	16 days.....	$6 per day..........	96 00
Charles Szen	Asst. eng'r in charge.	Expenses..	....	19 59
George P. Hilton......	Draughtsman.........	Plans.......	....	186 00
M. W. Wilbur..........	Leveler...............	78 days.....	$4.50 per day.......	351 00
M. W. Wilbur..........	Leveler...............	Expenses..	....	15 48
F. C. Gunn............	Leveler...............	2 days......	$4.50 per day	9 00
F. C. Gunn............	Leveler...............	Expenses..	....	8 17
M. W. Wilbur..........	Rodman..............	62 days....	$3.50 per day	217 00
M. W. Wilbur..........	Rodman..............	Expenses..	....	95 92
J. B. Barrett...........	Rodman..............	134 days....	$3.50 per day	469 00
J. B. Barrett...........	Rodman..............	Expenses..	....	107 45
D. R. Lee.	Rodman..............	2 days......	$3.50 per day	7 00
D. R. Lee..............	Rodman..............	Expenses..	....	7 72
C. A. Cockroft	Rodman..............	7 days......	$3.50 per day.......	24 50
C. A. Cockroft	Rodman..............	Expenses..	....	7 33
John Pinkel	Chainman............	8 days......	$2.50 per day	20 00
John Pinkel	Chainman............	Expenses..	....	7 52
				$5,281 33
Incidental Expenses.				
Stationery..........			$70 30	
Fuel, light and office rent..........			404 14	
Postage and telegraph..........			73 73	
Miscellaneous..........			143 00	691 17
Total..........				$5,972 50

EXTRAORDINARY REPAIRS.

Lengthening locks 63 *and* 64.—*Act chapter* 416, *Laws of* 1888.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
Geo. I. Bailey..........	Asst. eng'r in charge.	39...........	$6.00 per day.......	$234 00
Geo. I. Bailey..........	Asst. eng'r in charge.	Expenses..	....	12 48
D. R. Lee..............	Rodman..............	28...........	$3.50 per day.......	98 00
D. R. Lee..........	Rodman..............	Expenses..	....	5 66
Henry Geck	Chainman............	25...........	$2.50 per day.......	62 50
Henry Geck	Chainman............	Expenses..	....	3 86
				$416 50
Incidental Expenses.				
Stationery..........				21 59
Total..........				$438 09

EXTRAORDINARY REPAIRS — SURVEY FOR CLAIMS, BEFORE THE COURT OF CLAIMS.

Act chapter 249, *Laws of* 1888.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer	15	$2,000 per year	$95 85
John Bisgood	Resident engineer	Expenses		12 38
Geo. I. Bailey	Asst. eng'r in charge	33	$6.00 per day	198 00
Geo. I. Bailey	Asst. eng'r in charge	Expenses		30 69
M. W. Wilbur	Leveler	6	$4.50 per day	27 00
M. W. Wilbur	Leveler	Expenses		4 12
F. C. Gunn	Leveler	11	$4.50 per day	49 50
F. C. Gunn	Leveler	Expenses		8 06
W. T. Leighton	Leveler	14	$4.50 per day	63 00
W. T. Leighton	Leveler	Expenses		11 46
Edwin Styring	Rodman	9	$3.50 per day	31 50
Edwin Styring	Rodman	Expenses		6 91
D. R. Lee	Rodman	21	$3.50 per day	73 50
D. R. Lee	Rodman	Expenses		19 75
J. B. Barrett	Rodman	12	$3.50 per day	42 00
J. B. Barrett	Rodman	Expenses		9 78
D. M. Teller	Chainman	3	$2.50 per day	7 50
D. M. Teller	Chainman	Expenses		3 31
R. B. Green	Chainman	12	$2.50 per day	30 00
R. B. Green	Chainman	Expenses		10 28
M. F. Wemple	Chainman	12	$2.50 per day	30 00
M. F. Wemple	Chainman	Expenses		10 28
Henry Geck	Chainman	8	$2.50 per day	7 50
Henry Geck	Chainman	Expenses		1 98
D. F. Hennessy	Chainman	12	$2.50 per day	30 00
D. F. Hennessy	Chainman	Expenses		9 78
				$824 13

Incidental Expenses.

Peter Ring, livery, ten days at $6	$60 00	
Stationery	15 90	
		75 90
Total		$900 03

EXTRAORDINARY REPAIRS.

Oak Orchard Creek feeder — Act chapter 424, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer	3½	$2,000 per year	$22 37
John Bisgood	Resident engineer	Expenses		23 46
F. N. Kimball	Asst. eng'r in charge	3	$6.00 per day	18 00
F. N. Kimball	Asst. eng'r in charge	Expenses		19 44
Total				$83 27

EXTRAORDINARY REPAIRS.

Engineering expenses for cross-sectioning Erie canal for the fiscal year ending September 30, 1888 — *Act chapter* 416, *Laws of* 1888.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
F. C. Gunn	Leveler	25	$4.50 per day	$112 50
F. C. Gunn	Leveler	Expenses		59 87
D. R. Lee	Rodman	24	$3.50 per day	84 00
D. R. Lee	Rodman	Expenses		35 19
W. T. Leighton	Chainman	16	$2.50 per day	40 00
W. T. Leighton	Chainman	Expenses		21 56
D. M. Teller	Chainman	12	$2.50 per day	30 00
D. M. Teller	Chainman	Expenses		21 31
E. Parkhurst	Chainman	12	$2.50 per day	30 00
E. Parkhurst	Chainman	Expenses		16 82
Henry Geck	Chainman	24	$2.50 per day	60 00
Henry Geck	Chainman	Expenses		31 08
				$542 43

Incidental expenses.

Stationery	$15 00	
E. Dart, labor in making stakes	8 75	
Miscellaneous	17 40	
		41 15
Total		$583 48

EXTRAORDINARY REPAIRS.

Engineering expenses for lengthening lock No. 72, *on the Erie canal, for the fiscal year ending September* 30, 1888 — *Act chapter* 463, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer	22	$2,000 per year	$140 57
John Bisgood	Resident engineer	Expenses		73 84
Charles Szen	Asst. eng'r in charge	212	$6.00 per day	1,272 00
Charles Szen	Asst. eng'r in charge	Expenses		139 05
C. A. Cockroft	Rodman	195	$3.50 per day	682 50
C. A. Cockroft	Rodman	Expenses		12 80
John Pinkel	Chainman	184	$2.50 per day	460 00
John Pinkel	Chainman	Expenses		9 06
Fred. Kruger	Chainman	27½	$2.50 per day	68 75
William Toohey	Chainman	71	$2.50 per day	177 50
William Toohey	Chainman	Expenses		1 38
				$3,037 45

Incidental Expenses.

Fuel, light and office rent	106 50
Total	$3,143 95

EXTRAORDINARY REPAIRS.

Engineering expenses for lengthening locks on the Erie canal, for the fiscal year ending September 30, 1888 — Act chapter 113, Laws of 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer	58	$2,000 per year	$370 62
John Bisgood	Resident engineer	Expenses		72 60
Byron Holley	Asst. eng'r in charge.	157	$6.00 per day	942 00
Byron Holley	Asst. eng'r in charge.	Expenses		192 54
George I. Bailey	Asst. eng'r in charge.	238	$6.00 per day	1,428 00
George I. Bailey	Asst. eng'r in charge.	Expenses		299 22
F. N. Kimball	Asst. eng'r in charge.	257	$6.00 per day	1,542 00
F. N. Kimball	Asst. eng'r in charge.	Expenses		308 48
M. W. Wilbur	Leveler	120	$4.50 per day	540 00
M. W. Wilbur	Leveler	Expenses		40 62
W. T. Leighton	Leveler	71	$4.50 per day	319 50
W. T. Leighton	Leveler	Expenses		4 02
F. C. Gunn	Leveler	236	$4.50 per day	1,062 00
F. C. Gunn	Leveler	Expenses		29 32
J. E. Ostrander	Leveler	230	$4.50 per day	1,035 00
J. E. Ostrander	Leveler	Expenses		49 05
G. C. Mills	Leveler	151	$4.50 per day	679 50
G. C. Mills	Leveler	Expenses		28 85
J. B. Barrett	Rodman	131	$3.50 per day	472 50
J. B. Barrett	Rodman	Expenses		28 56
George J. Bischof	Rodman	219	$3.50 per day	766 50
George J. Bischof	Rodman	Expenses		3 64
D. R. Lee	Rodman	189	$3.50 per day	661 50
D. R. Lee	Rodman	Expenses		72
Edwin Styring	Rodman	206	$3.50 per day	721 00
Edwin Styring	Rodman	Expenses		5 90
S. L. Way	Rodman	157	$3.50 per day	549 50
S. L. Way	Rodman	Expenses		30 75
W. T. Leighton	Rodman	102	$3.50 per day	357 00
W. T. Leighton	Rodman	Expenses		32 65
Henry Geck	Chainman	260	$2.50 per day	650 00
Henry Geck	Chainman	Expenses		62 22
Henry Blum	Chainman	59	$2.50 per day	147 50
Henry Blum	Chainman	Expenses		5 71
Charles Raymond	Chainman	146	$2.50 per day	365 00
Charles Raymond	Chainman	Expenses		3 16
M. F. Wemple	Chainman	104	$2.50 per day	260 00
M. F. Wemple	Chainman	Expenses		14 30
Wm. Toohey	Chainman	39	$2.50 per day	97 50
Wm. Toohey	Chainman	Expenses		3 40
D. M. Teller	Chainman	216	$2.50 per day	540 00
D. M. Teller	Chainman	Expenses		15 38
R. B. Green	Ohainman	255	$2.50 per day	637 50
R. B. Green	Chainman	Expenses		80 86
				$15,456 07

Incidental Expenses.

Stationery	$144 74	
Fuel, light and office rent	145 63	
Postage and telegraph	85 12	
Miscellaneous	229 30	
		604 79
Total		$16,060 86

EXTRAORDINARY REPAIRS.

Main street bridge, Brockport, N. Y.—Act chapter 118, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer	46	$2,000 per year	$293 94
John Bisgood	Resident engineer	Expenses		39 05
M. W. Wilbur	Leveler	21	$4.50 per day	94 50
M. W. Wilbur	Leveler	Expenses		31 82
J. B. Barrett	Rodman	9	$3.50 per day	31 50
J. B. Barrett	Rodman	Expenses		15 68
Total				$506 49

EXTRAORDINARY REPAIRS.

South Tonawanda culverts—Act chapter 348, *Laws of* 1888.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
Geo. I. Bailey	Asst. eng'r in charge	23	$6.00 per day	$138 00
Geo. I. Bailey	Asst. eng'r in charge	Expenses		31 27
M. W. Wilbur	Leveler	9	$4.50 per day	40 50
M. W. Wilbur	Leveler	Expenses		19 42
W. T. Leighton	Leveler	2	$4.50 per day	9 00
J. B. Barrett	Rodman	9	$3.50 per day	31 50
J. B. Barrett	Rodman	Expenses		21 42
Henry Geck	Chainman	1	$2.50 per day	2 50
Henry Geck	Chainman	Expenses		3 34
Total				$296 95

EXTRAORDINARY REPAIRS.

Glasgow street bridge, Clyde, N. Y.—Act chapter 402, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer	5	$2,000 per year	$31 95
John Bisgood	Resident engineer	Expenses		11 89
George P. Hilton	Draughtsman			84 00
F. N. Kimball	Asst. eng'r in charge	10	$6.00 per day	60 00
M. W. Wilbur	Leveler	1	$4.50 per day	4 50
M. W. Wilbur	Leveler	Expenses		2 82
J. B. Barrett	Rodman	1	$3.50 per day	3 50
J. B. Barrett	Rodman	Expenses		2 82
Total				$201 48

EXTRAORDINARY REPAIRS.

Main street bridge, Rochester, N. Y.— Act chapter 351, *Laws of* 1888.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer....	7½..........	$2,000 per year	$17 92
M. W. Wilbur..........	Leveler................	4...........	$4.50 per day	18 00
J. B. Barrett...........	Rodman	3............	$3.50 per day	10 50
M. F. Wemple	Chainman..............	2............	$2.50 per day	5 00
M. F. Wemple	Chainman	Expenses..	....	3 22
Total				$84 64

EXTRAORDINARY REPAIRS.

Main street bridge, Tonawanda, N. Y.— Act chapter 585, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer....	2............	$2,000 per year.....	$12 78
John Bisgood	Resident engineer....	Expenses..	....	4 14
Charles Szen	Asst. eng'r in charge.	6............	$6.00 per day	36 00
Charles Szen	Asst. eng'r in charge.	Expenses..	....	10 69
C. A. Cockroft	Rodman	4............	$3.50 per day	14 00
C. A. Cockroft	Rodman	Expenses..	....	7 03
John Pinkel	Chainman	4............	$2.50 per day	10 00
John Pinkel	Chainman	Expenses.	....	7 72
Total.....................				$102 36

EXTRAORDINARY REPAIRS.

Austin street bridge, Buffalo, N. Y.— Act chapter 587, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer....	5............	$2,000 per year.....	$31 95
John Bisgood	Resident engineer....	Expenses..	....	6 98
Charles Szen	Asst. eng'r in charge.	13...........	$6.00 per day	78 00
C. A. Cockroft	Rodman	13...........	$3.50 per day	45 50
John Pinkel	Chainman	25...........	$2.50 per day	62 50
Geo. P. Hilton.........	Draughtsman.........	....	....	43 00
Total.....................				$267 93

EXTRAORDINARY REPAIRS.

Iron pipe under canal between Ninth and Tenth streets, Rochester, N. Y.— Act chapter 352, *Laws of* 1888.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer....	8...........	$2,000 per year	$51 12

EXTRAORDINARY REPAIRS.

Cottage street bridge, Lockport, N. Y.— Act chapter 150, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood	Resident engineer....	5...........	$2,000 per year	$31 95
John Bisgood	Resident engineer....	Expenses..	....	13 58
M. W. Wilbur..........	Leveler..............	2...........	$4.50 per day.......	9 00
M. W. Wilbur..........	Leveler..............	Expenses..	....	9 04
J. B. Barrett	Rodman..............	2...........	$3.50 per day.......	7 00
J. B. Barrett	Rodman..............	Expenses..	....	9 04
Total....				$79 61

EXTRAORDINARY REPAIRS.

Hudson street bridge, Buffalo, N. Y.— Act chapter 59, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total Amount.
John Bisgood	Resident engineer....	6...........	$2,000 per year	$38 34
John Bisgood	Resident engineer....	Expenses..	....	6 52
Fred Krueger	Chainman	7½..........	$2.50 per day.......	187
Total..				$63 61

EXTRAORDINARY REPAIRS.

Geneva street bridge, Lyons, Wayne county, N. Y.— Act chapter 546, *Laws of* 1888.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood..........	Resident engineer....	6............	$2,000 per year.....	$38 34
John Bisgood..........	Resident engineer....	Expenses..	....	4 58
M. W. Wilbur..........	Leveler	2............	$4.50 per day	9 00
M. W. Wilbur..........	Leveler	Expenses..	....	4 58
J. B. Barnett	Rodman	2............	$3.50 per day	7 00
J. B. Barnett	Rodman	Expenses..	....	4 58
D. R. Lee	Rodman	1............	$3.50 per day	3 50
D. R. Lee	Rodman	Expenses..	....	2 54
Total..				$74 12

EXTRAORDINARY REPAIRS.

Parker street bridge, Fairport, Monroe county, N. Y.— Act chapter 612, *Laws of* 1887.

NAME.	Rank.	Number of days, etc.	Rate of compensation.	Total amount.
John Bisgood..........	Resident engineer....	9............	$2,000 per year.....	$57 51
John Bisgood..........	Resident engineer....	Expenses..	....	9 37
George P. Hilton......	Draughtsman.........	Plans	....	24 00
M. W. Wilbur..........	Leveler	8............	$4.50 per day	36 00
M. W. Wilbur..........	Leveler	Expenses..	....	5 90
J. B. Barrett...........	Rodman	6............	$3.50 per day	21 00
J. B. Barrett...........	Rodman	Expenses..	....	3 30
Total				$157 08

Summary of engineering expenses upon the Western Division New York State canals, for the fiscal year ending September 30, 1888.

Ordinary repairs	$5,972 50
Extraordinary repairs:	
Survey for Court of Claims, act chapter 249, Laws of 1888,	900 03
Oak Orchard Creek feeder, act chapter 424, Laws of 1887,	83 27
Cross-sectioning Erie canal, act chapter 416, Laws of 1888..	583 48
Lengthening lock No. 72, act chapter 463, Laws of 1887,	3,143 95
Lengthening locks, Erie canal, act chapter 113, Laws of 1887..	16,060 86
Lengthening locks Nos. 63 and 64, Erie canal, act chapter 416, Laws of 1888	438 09

South Tonawanda culverts, act chapter 348, Laws of 1888,	$296 95
Brockport bridge, act chapter 118, Laws of 1887.......	506 49
Clyde bridge, act chapter 402, Laws of 1887...........	201 48
Main street bridge, Rochester, act chapter 351, Laws of 1888..	84 64
Main street bridge, Tonawanda, act chapter 585, Laws of 1887..	102 36
Austin street bridge, Buffalo, act chapter 587, Laws of 1887..	267 93
Lockport bridge, act chapter 150, Laws of 1887........	79 61
Hudson street bridge, Buffalo, act chapter 59, Laws of 1887..	63 61
Lyons bridge, act chapter 546, Laws of 1888...........	74 12
Fairport bridge, act chapter 612, Laws of 1887	157 08
Iron pipe under canal in Rochester, act chapter 352, Laws of 1888..................................	51 12
Total engineering expenses western division	$29,067 57

TABLE OF BRIDGES.

Number.	NAME.	Class.	Plan.	Material.	Clear span.	Number of roadways.	C. to C. trusses.	Number of sidewalks.	Width of sidewalks.	Skew.	When erected.	Cost of superstructure.
1	Wayne county line	Highway.	Whipple, truss	W.& I.	72.3	1	17.3				1882	Supt.
2	Pit lock	Highway.	Whipple, truss	W	72.5	1	17.2				1881	Supt.
3	Waldruff's	Highway.	Whipple, truss	W	73	1	17.3				1879	Supt.
4	Glasgow street, Clyde	Highway.	Lift, lattice	Wt. I.	22	1	75.3	2	6	8° 10′ R	1888	$6,623.
5	Sodus street, Clyde	Highway.	Whipple, arch	C. I.	79.8	1	19.1	2	6	22° R	1854	$2,354.10.
6	Sigman	Farm	Whipple, truss	W	71.6	1	12.1				1879	Supt.
7	Barker's	Farm	Whipple, truss	W	71.2	1	12.2				1883	Supt.
8	Long's	Farm	Whipple, truss	W	70.7	1	12.2				1882	Supt.
9	Lock, Berlin	Highway.	Lattice	Wt. I.	71.6	1	17				1881	$1,192.44.
10	Horton's	Highway.	Whipple, arch	C. I.	71.4	1	17.5				1879	$929.83.
11	Goetzman	Farm	Whipple, truss	W.& I.	71.5	1	11.6				1881	Supt.
12	Klau's	Highway.	Whipple, truss	W	73.90	1	17				1882	Supt.
13	Richmond	Farm	Whipple, truss	W	73.11	1	12				1881	Supt.
14	Cole's	Highway.	Lattice	Wt. I.	73.10	1	17				1882	$1,227.72.
15	Geneva street, Lyons	Highway.	Whipple, arch	C. I.	84	1	19.1	2	4.8 6	16° R	1856	$2,024.
16	Church street, Lyons	Highway.	Whipple, arch	C. I.	99.5	1	19.1	2	5.6 7	34° 55′ L	1855	$3,100.50,
17	Water street, Lyons	Highway.	Whipple, arch	C. I.	86.6	1	19.1	2	6	21° 15′ L	1856	$2,479.40.
18	Leache's, Lyons	Highway.	Whipple, arch	C. I.	72.10	1	17.1				1872	$2,470.55.
19	Prime's	Farm	Whipple, truss	W	71.5	1	12.2				1882	Supt.
20	Park's	Highway.	Lattice	Wt. I.	82.6	1	17				1882	$1,515.50,
21	Mosher's	Highway.	Lattice	Wt. I.	71	1	17				1882	$1,192.44.
22	Change bridge	Change	Bowstring	Wt. I.	71.10	1	12				1881	$1,123.91.
23	Lockville	Highway.	Whipple, arch	C. I.	99.5	1	19.3			1° 35′ L	1873	$4,998.23.
24	Charles street, Newark	Highway.	Whipple, arch	C. I.	73.10	1	19			6° 30′ R	1856	$1,364.10.
25	Main street, Newark	Highway.	Whipple, arch	C. I.	78.6	1	19.1	2	4.9 6		1856	$2,069.47.
26	Allerton's	Highway.	Whipple, arch	C. I.	71.3	1	17				1880	G. V. canal.
27	Peck's	Highway.	Whipple, arch	C. I.	71.4	1	18				1884	G. V. C.
28	Sweezy's	Farm	Whipple, truss	W	72.5	1	17.2				1871	Supt.
29	Palmer's	Highway.	Whipple, truss	W	71.4	1	17.1				1883	Supt.
30	Port Gibson	Highway.	Whipple, arch	C. I.	87	1	19.2				1859	$1,729.
31	Galloway's	Highway.	Lattice	Wt. I.	72.2	1	17				1881	$1,192.44.
31½	Kent street, Palmyra	Highway.	Swartz's patent	C. I.	90	1	19				1882	Com. st., Buffalo.
32	Railroad ave., Palmyra	Highway.	Whipple, arch	C. I.	96	2	18.3 18.6	1	6	32° 15′ R	1870	$5.406.
33	Market street, Palmyra	Highway.	Whipple, arch	C. I.	80.1	1	18	1	6	4° 55′ L	1870	$2,689.25.

34	Church street, Palmyra..	Highway.	Whipple, arch................	C. I...	80.11	1	19.4	....	......	....	1857	$1,386.
35	Change bridge...........	Change ..	Pipe, truss....	C. I...	71.10	1	12.3	....	......	....	1880	W.-lock, Rochest'r.
36	Crandall's...............	Highway.	Whipple, truss....	W	71.11	1	17	....	......	....	?	Supt.
37	Clark's..................	Farm.....	Whipple, truss....	W	72.2½	1	12.2	....	......	....	1879	Supt.
38	White's	Highway.	Whipple, arch....	C. I...	71.1	1	17	....	......	....	1880	G. V. C.
39	Highway and change	Highway.	Lattice....	Wt. I.	73	1	16	1	9	....	1881	$1,792.44.
40	Macedon	Highway.	Whipple, arch....	C. I...	72.3	1	17.3	....	......	....	1860	$1,092.40.
41	Frear's	Highway.	Whipple, truss, cove sheathed	W	72.3	1	17	....	......	....	1858	Supt.
42	Wayneport...............	Highway.	Whipple, truss, sheathed....	W	70.2	1	17.6	....	......	....	1858	Supt.
43	Knapp's	Highway.	Whipple, truss	W	72.8	1	17	....	......	....	1886	Supt.
44	Baker's	Highway.	Whipple truss....	W.& I.	72.10	1	18.10	....	......	....	1884	Supt.
45	Parker's	Highway.	Lattice	Wt. I.	86	1	17	1	5	3° R	1888	$2,184.
46	Main street, Fairport.....	Highway.	Whipple, arch....	C. I...	84.7	1	19.2	2	6	30° 26′ L	1856	$2,212.50.
47	Fullam basin	Highway.	Whipple, truss....	W	76	1	17.1	....	......	13° 30′ R	1886	Supt.
48	Wapping	Highway.	Whipple, truss....	W & I	83.7	1	17.6	....	......	27° 45′ L	1877	Supt.
49	Wiltsie's................	Highway.	Whipple, arch....	C. I...	74.4	1	20.1	....	......	10° 30′ L	1882	Brown st., Roch'r.
50	Bushnell's basin..........	Highway.	Whipple, arch....	C. I...	83.11	1	19.1	2	6	30° 30′ L	1856	$2,212.50.
51	Cartersville.	Highway.	Whipple, truss....	W	75.3	1	17.	....	......	....	1885	Supt.
52	Guernsey................	Farm	Whipple, truss....	W.&I.	99.9	1	17.1	....	......	10° 35′ R	1875	Supt.
53	Pittsford.................	Highway.	Whipple, arch................	C. I...	83.8	1	19.1	2	6.7	32° 46′ R	1870	$1,526.50.
54	Main street, Pittsford....	Highway.	Whipple, arch................	C. I...	77.11	1	19.1	2	4.6 5	24° 20′ L	1856	$1,927.
55	Sutherland's	Highway.	Whipple, arch................	C. I...	84.8	1	19.	....	......	31° 45′ L	1879	Genesee st., Buff.
56	Cook's	Highway.	Whipple, truss................	W.&I.	74.8	1	14.8	....	......	12° 45′ R	1877	Supt.
57	Weed's..................	Highway.	Whipple, truss................	W.....	74.7	1	17.	....	......	....	1885	Supt.
58	Billinghurst..............	Highway.	Whipple, arch................	C. I...	74.	1	18.3	....	......	....	1867	$2,117.41.
59	Donnely's	Highway.	Whipple, truss................	W.....	73.6	1	17.3	....	......	2° 10′ L	1876	Supt.
60	Drake's	Highway.	Whipple, truss................	W.&I.	73.	1	17.1	....	......	2° 10′ L	1876	Supt.
61	Brighton	Highway.	Whipple, arch................	C. I...	76.3	1	18.	....	......	15° 50′ R	1857	$1,336.50.
62	Culver road	Highway.	Whipple, truss................	W.&I.	80.	1	15.4	....	......	....	1877	Supt.
63	Monroe ave., Rochester..	Highway.	Lattice	Wt. I.	112.	1	21.	2	7.	45° L	1887	$4,975.
64	Goodman st., Rochester..	Highway.	Whipple, arch................	C. I...	91.1	1	17.5	2	6.	18° R	1875	$2,730.
65	Nelson street, Rochester.	Highway.	Cooper, arch	Wt. I.	91.1	1	19.	2	6.	10° 10′ L	1873	$4,320.
66	Averill ave., Rochester...	Highway.	Whipple, arch................	C. I...	84.11	1	18.2	2	6.	....	1875	$1,530.
67	Alexander st., Rochester.	Highway.	Whipple, arch................	C. I...	74.2	1	19.	2	6.	....	1856	$1,880.
67½	Pinnacle ave., Rochester.	Highway.	Lattice................	W.&I.	88.	1	19.	2	6.6	10° 45′ L	1887	$2,631.
68	St. Paul st., Rochester....	Highway.	Lattice................	W.& I.	113.6	2	18.2	2	8.	50° 45′ L	1875	$6,925.50.
69	Griffith street, Rochester.	Highway.	Pipe, truss	C. I.	108 E. 102 W.	1	16.9	....	......	23° 52′ R	1864	$4,012.31.
70	Weigh-lock, Rochester...	Change ..	Bow-string	W. I..	137.	1	13.4	....	......	....	1880	$4,655.
71	Court street, Rochester ..	Highway.	Whipple, arch................	C. I...	75.8	2	15.8	2	7.6	3° 45′ L	1856	$1,880.
73	Exchange st., Rochester..	Highway.	Swing................	Wt. I.	83.6	1	18.	2	5.4	....	1869	$6,475.
74	Fitzhugh st., Rochester..	Highway.	Whipple, arch................	C. I...	86.7	1	18.2	2	9.1	7° 12′ R	1859	$2,430.
76	Washington street, Roch.	Highway.	Bollman, truss................	C. I...	85.6	1	21.3	2	9.2	17° 15′ L	1855	$3,864.95.
77	West avenue, Rochester..	Highway.	Swing................	Wt. I.	82.9	1	18.	2	6.6	....	1875	$8,050.
78	Ford street, Rochester....	Highway.	Bollman, truss................	C. I...	95.8	1	15.6	2	5.4	26° 30′ L	1855	$4,021.39.
79	Genesee valley canal.....	Tow-path	Whipple, pipe truss...........	C. I...	91	1	14.10	....	......	....	1873	$1,991.48.
82	Jay street, Rochester.....	Highway.	Whipple, arch................	C. I...	84.2	1	20.3	2	6.6	10° 30′ L	1859	$1,504.50.
83	Smith street, Rochester..	Highway.	Whipple, arch................	C. I...	92.10	1	16	2	5	18° 30′ R	1873	$2,601.20.
85	Emerson st., Rochester ..	Highway.	Bollman, truss................	C. I...	106.10	1	18	2	6.8	23° R	1875	West avenue.

TABLE OF BRIDGES — (*Continued*).

Number.	NAME.	Class.	Plan.	Material.	Clear span.	Number of roadways.	C. to C. trusses.	Number of sidewalks.	Width of sidewalks.	Skew.	When erected.	Cost of superstructure.
86	Rowe street, Rochester	Highway.	Whipple, arch	C. I.	95.5	1	18.10	....	......	30° 4′ R	1873	$2,200.
87	Change	Change	Bowstring	W.& I.	82.7	1	13	....	......	....	1879	$700.
88	Scott's	Highway.	Whipple, truss	W.& I.	82.2	1	15.4	....	......	18° 45′ L	1877	Supt.
89	Four-mile grocery	Highway.	Whipple, truss	W	81.2	1	17	....	......	15° 45′ R	1880	Supt.
90	Speirs	Highway.	Whipple, truss	W.& I.	81.2	1	17	....	......	10° 30′ R	1876	Supt.
91	Six-mile grocery	Highway.	Whipple, trapezoidal truss	C. I.	93.2	1	19.2	....	......	30° L	1887	Monroe avenue.
92	Douglass	Farm	Whipple, truss	W	80.6	1	13.4	....	......	....	1875	Supt.
93	Finley	Highway.	Whipple, truss	W.& I.	83.8	1	17.4	....	......	18° 45′ R	1877	Supt.
94	South Greece	Highway.	Whipple, truss	W.& I.	92.1	1	19	....	......	28° 32′ L	1881	Supt.
95	Cromwell's	Highway.	Whipple, truss	W	81.10	1	17.3	....	......	....	1875	Supt.
96	Hiscock's	Highway.	Whipple, arch	C. I.	81	1	16	....	......	....	1881	G. V. C.
97	Norman's	Farm	Whipple, truss	W	81.8	1	13.3	....	......	....	1875	Supt.
98	Union street, Spencerport	Highway.	Whipple, arch	C. I.	86.5	1	19	2	5.7	11° 22′ L	1857	$2,366.
99	Amity street, Spencerport	Highway.	Whipple, arch	C. I.	94.8	1	18.6	....	......	21° 10′ L	1873	$2,277.
100	Webster's, east	Highway.	Whipple, truss	W	83.2	1	15.3	....	......	....	1872	Supt.
101	Webster's, west	Highway.	Whipple, truss	W	82.8	1	19.6	....	......	....	1887	Supt.
102	Crissey's	Highway.	Whipple, trapezoidal truss	C. I.	81.2	1	19.6	....	......	3° 30′ L	1876	Exch. st., Buffalo.
103	Adams basin	Highway.	Whipple, arch	C. I.	82.4	1	19	2	5.8	5° 45′ L	1858	$1,903.
104	Doty's	Highway.	Whipple, truss	W.&I.	83.7	1	17.2	....	......	....	1876	Supt.
105	Brockway	Highway.	Whipple, arch	C. I.	82.9	1	14.7	....	......	....	1879	Gen. st., Buffalo.
106	Cooley basin	Highway.	Whipple, arch	C. I.	82.4	1	17.3	....	......	....	1879	Gen. st., Buffalo.
107	Mechanic st., Brockport	Highway.	Whipple, arch	C. I.	84.8	1	18.4	2	6.1	11° 30′ L	1859	$1,496.
108	Main street, Brockport	Highway.	Lift, lattice	Wt. I.	83.6	1	22	2	6	9° 20′ L	1888	$7,461.
109	Smith street, Brockport	Highway.	Whipple, arch	C. I.	84.10	1	18	2	6	....	1870	$3,204.
110	Danforth's	Highway.	Whipple, arch	C. I.	90.7	1	18.3	....	......	....	1883	Lyel ave., Roch'r.
111	Miner's town line	Highway.	Lattice	Wt. I.	86	1	18	....	......	....	1881	$1,651.94.
112	County line	Highway.	Whipple, truss	C. I.	91.4	1	18	....	......	19° 15′ L	1883	Lyel ave., Roch'r.
113	Orrs	Highway.	Bowstring	Wt. I.	87.4	1	15.5	....	......	....	1879	$1,075.
114	Frisby's old canal Holley	Highway.	Whipple, arch	C. I.	80	1	14.6	2	5.3	9° 30′ L	1849	
115	Holley	Highway.	Whipple, arch	C. I.	87.10	1	19	....	......	....	1857	$2,002.
116	McCarty's	Highway.	Whipple, arch	C. I.	87.2	1	18	....	......	8° 30′ L	1871	$2,216.36.
117	Tuttle's	Highway.	Swartz	C. I.	88	1	18	....	......	....	1882	Lloyd street, Buff.
118	McGuire's	Highway.	Whipple, truss	W.& I.	88	1	15	....	......	....	1876	Supt.
119	Hulburton	Highway.	Whipple, arch	C. I.	91.5	1	18.10	2	5.8	13° 06′ R	1856	$2,101.
120	Brockville	Highway.	Whipple, arch	C. I.	92.9	1	16.9	....	......	16° 45′ L	1871	$960.
121	Hindsburg	Highway.	Whipple, arch	C. I.	91.8	1	18.9	1	5.10	11° R	1856	$2,888.50.
122	Transit	Highway.	Bowstring	Wt. I.	88.8	1	15.5	....	......	2° 50′ R	1879	$1,095.
123	Jaqueth's	Highway.	Whipple, truss	W.& I.	90.6	1	17	....	......	....	1876	Supt.

124	Bidwell's	Highway.	Whipple, truss	W	89.6	1	15.2	....	......	....	1885	Supt.
125	Brailey	Highway.	Swartz	C. I.	90	1	18	...	......	....	1883	Lloyd street, Buff.
126	Hall's	Highway.	Whipple, arch	C. I.	91	1	19	....	......	5° 50′ R	1856	$2,106.50.
127	Ingersoll street, Albion	Highway.	Bowman	C. I.	94.3	1	20	2	4.8	15° 42′ L	1855	$3,734.10.
128	Batavia street, Albion	Highway.	Swing	Wt. I.	82.2	1	17	2	5	....	1871	$6,825.
129	Lattin's	Farm	Whipple, truss	W	107.4	1	14.6	....	......	26° 48′ L	1881	Supt.
130	Gaines' Basin	Highway.	Lattice	Wt. I.	107.10	1	19.8	....	......	32° 20′ L	1881	$3,083.80.
131	Eagle Harbor	Highway.	Whipple, arch	C. I.	104.5	1	19	2	5.6	29° R	1856	$2,874.57.
132	Starkweather	Farm	Whipple, truss	W	91.10	1	15	....	......	....	1885	Supt.
133	Allen's	Highway.	Whipple, arch	C. I.	92	1	18	....	......	5° 36′ R	1882	Buff.
134	Longs	Highway.	Whipple, truss	W	102.2	1	18.9	....	......	26° R	1885	Supt.
135	Knowlesville	Highway.	Whipple, arch	C. I.	102.2	1	20.4	2	5.6	25° 20′ R	1856	$2,743.13.
136	Beals'	Highway.	Whipple, truss	W.	91.6	1	15	....	......	4° 12′ R	1885	Supt.
137	Hastings	Highway.	Whipple, arch	C. I.	95.2	1	18.2	....	......	20° 54′ R	1877	$2,100,
138	Holloways	Highway.	Whipple, arch	C. I.	99.3	1	19	....	......	....	1869	$2.792.02.
139	Church street, Medina	Highway.	Whipple, arch	C. I.	95.3	1	17.6	2	5.3	....	1850	
140	Shelby street, Medina	Highway.	Whipple, arch	C. I.	91	1	19	2	5.9	....	1855	$2,520.
140½	Prospect street, Medina	Highway.	Lattice	Wt. I.	99.7	1	19	....	......	5° L	1885	$2,250.
141	Jackson's	Highway.	Whipple, truss	W.	95.2	1	17.2	....	......	15° 40′ R	1876	Supt.
142	Shelby basin	Highway.	Lattice	Wt. I.	107.1	1	19	....	......	14° 30′ R	1886	$3,340.
143	Town line	Highway.	Whipple, truss	W.	91.19	1	19	....	......	....	1887	Supt.
144	Vernon street, Middleport	Highway.	Whipple, truss	W.	99.10	1	17.6	....	......	21° 40′ R	1885	Supt.
145	Main street, Middleport	Highway.	Whipple, arch	C. I.	99.9	1	18.10	2	5.10	23° 08′ R	1856	$2,730.
146	Williams'	Highway.	Lattice	Wt. I.	91.6	1	17	....	......	....	1881	$1,609.11.
147	Watson's	Highway.	Whipple, truss	W.	91.2	1	17.2	....	......	7° 10′ R	1887	Supt.
148	Hurd's	Highway.	Lattice	Wt. I.	94	1	17.6	....	......	10° 42′ R	1881	$1,843.50.
149	Reynales' basin	Highway.	Whipple, truss	W.	107.8	1	17.4	....	......	14° 14′ L	1885	Supt.
150	Maybee's	Highway.	Whipple, arch	C. I.	100.8	1	19	....	......	3° 22′ R	1871	$2,493.75.
151	Gasport	Highway.	Lattice	Wt. I.	99.7	1	19	....	......	10° 38′ R	1885	$2,250.
152	Orangeport	Highway.	Whipple, arch	C. I.	99.1	1	19	1	4.09	18° 06′ R	1871	$3,071.66.
153	Millard's	Highway.	Whipple, arch	C. I.	98.1	1	19	....	......	1° 48′ R	1857	$3,381.20.
154	Wakeman's	Highway.	Whipple, truss	W.	98.3	1	14.6	....	......	....	1882	Supt.
155	Young's	Highway.	Whipple, arch	C. I.	99.5	1	19	....	......	....	1857	$3,381.20.
156	Comstock's	Highway.	Whipple, arch	C. I.	103.4	1	19	2	6.2	....	1857	$2,682.
157	Adams street, Lockport	Highway.	Whipple, arch	C. I.	103	1	17	....	......	....	1855	
158	Chapel street, Lockport	Highway.	Whipple, arch	C. I.	81.3	1	17	....	......	....	1855	
159	Exchange st., Lockport	Highway.	Bollman, truss	C. I.	80.5	1	20	2	6.3	....	1855	$3,163.51.
160	Cady's, Lockport	Highway.	Whipple, truss	W.&I.	88	1	15	....	......	....	1887	Supt.
161	Pine street, Lockport, A	Highway.	Whipple, trapezoidal truss	C. I.	112.5	1	21.8	2	5.10	19° 30′ R	1853	$6,874.12.
161	Pine street, Lockport, B	Highway.	Whipple, trapezoidal truss	C. I.	54.11	1	21.8	2	5.10	19° 30′ R	1853	
162	Cottage street, Lockport	Highway.	Roof trussed, arch	Wt. I.	84.8	1	24	2	5.7	16° 08′ R	1888	$2,662.
163	Main street, Lockport	Highway.	Roof trussed, arch	Wt. I.	73.37	1	259.4	2	5.7	55′ R	1887	$12,776.
164	Transit street, Lockport	Highway.	Whipple, arch	C. I.	114	1	19	2	5.4	41° 12′ R	1872	$4,352.
165	Hitchins	Highway.	Whipple, arch	C. I.	74.2	1	18	....	......	....	1870	$1,794.
166	Heacock, A	Highway.	Whipple, truss	W	42.3	1	15	....	......	....	1885	Supt.
166	Heacock, B	Highway.	Whipple, arch	C. I.	99.4	1	15	....	......	....	1856	$5,629.20.
166	Heacock, C	Highway.	Whipple, truss	W	47.8	1	15	....	......	....	1876	Supt.
167	Hawley's, A	Highway.	Whipple, truss	W	37	1	15.6	....	......	....	1877	Supt.
167	Hawley's, B	Highway.	Whipple, trapezoidal truss	C. I.	100.3	1	15.1	....	......	....	1856	$2,575.
167	Hawley's, C	Highway.	Whipple, truss	W	37	1	15.6	....	......	....	1877	Supt.

TABLE OF BRIDGES — (*Continued*).

Number.	NAME.	Class.	Plan.	Material.	Clear span.	Number of roadways.	C. to C. trusses.	Number of sidewalks.	Width of sidewalks.	Skew.	When erected.	Cost of superstructure.
168	Sulphur Spr. g'rd-lock, A.	Highway.	Whipple, truss	W	46.9	1	11.1				1877	Supt.
168	Sulphur Spr. g'rd-lock, B.	Highway.	Whipple, truss	W	34.4	1	11.1				1877	Supt.
168	Sulphur Spr. g'rd-lock, C.	Highway.	Whipple, truss	W	37.8	1	11.1				1877	Supt.
169	Pendleton, A	Highway.	Whipple, trapezoidal truss	C, I.	102	1	13				1854	$3,300.
169	Pendleton, B	Change	Whipple, pipe truss	C. I.	102	1	9.2				1854	
170	Old canal, Pendleton	Highway.	Pipe truss	C. I.	35.6	1	17				1883	G. V. canal.
171	Tonawanda creek, 3 spans	Tow-path	Whipple, truss	W. & I.	61.2	1	11			29° 56′ R	1877	Supt.
172	Ransom's creek	Tow-path	Whipple, truss	W	33.4	1	14				1887	Supt.
173	New Home	Highway.	Whipple, truss	W. & I.	93.11	1	18.2			28° 20′ R	1886	Supt.
174	Pickard's, A	Highway.	Whipple, truss	W. & I.	107.5	1	17.6				1882	Supt.
174	Pickard's, B	Highway.	Whipple, truss	W. & I.	66.8	1	17.6				1865	Supt.
174	Pickard's, C	Highway.	Whipple, truss	W	31.6	1	17.6				1885	Supt.
175	Bush's	Highway.	Bowstring, arch	Wt. I.	171.1	1	18.8				1873	$7,965.
176	Ellicott creek	Tow-path	Pipe, truss	C. I.	49.9	1	13.6				1883	W.-lock, Rochest'r
177	Main street, Tonawanda.	Highway.	Lattice	Wt. I.	88	1	29	2	10 6	13° 08′ R	1888	$5,476.
178	River lock slip, Tonaw'da	Highway.	Whipple, arch	C. I.	52.2	1	18.3			4° 25′ R	1871	$1,800.
179	Seymour st., Tonawanda	Highway.	Whipple, arch	C. I.	84	1	18.3	2	6.5		1857	$1,710.
180	Bouck street, Tonawanda	Highway.	Bollman, truss	C. I.	83.10	1	18.8	2	6.3		1867	
181	Change bridge, Tonaw'da	Change	Whipple, pipe truss	C. I.	95.7	1	14.3				1857	$1,633.12.
182	Grand Island Ferry, Tonawanda	Highway.	Whipple, arch	C. I.	95.7	1	17				1874	$3,368.77.
183	Three mile	Farm	Whipple, truss	W. & I.	84.8	1	16				1881	Supt.
184	Cherry's	Farm	Whipple, truss	W. & I.	83.8	1	15.7				1880	Supt.
185	Lineburg	Farm	Whipple, truss	W	82.11	1	15				1879	Supt.
186	Scott's Gd. Island Ferry	Highway.	Whipple, arch	C. I.	81.10	1	17.6				1879	G. V. canal.
187	Change, Black Rock	Change	Whipple, pipe truss	C. I.	93.8	1	17.6				1856	$2,167.
188	Pratt's slip, Black Rock	Tow-path	Swartz, lift	Wt. I.	21.10	1	10.4				1873	$1,721.09.
189	Bird street, Black Rock	Highway.	Whipple, arch	C. I.	104.1	1	18.1				1871	$3,488.
189½	Austin street, Black Rock	Highway.	Lattice	Wt. I.	122	1	19			1° 0′ L.	1888	$3,741.
190	Hamilton st., Black Rock	High'y & change.	Cooper, arch	Wt. I.	108	1	18.3				1873	$4,197.96.
191	Amherst st., Black Rock	Highway.	Whipple, arch	C. I.	117.3	1	19	2	6		1857	$3,096.90.
192	Mill street, Black Rock	Highway.	Whipple, truss	W	117.6	1	13				1882	Supt.
193	Scajaquada creek, Black Rock	Tow-path	Arch, draw	W	41.6	1	12				1885	Supt.
194	Ferry street, Buffalo	Highway.	Lattice	Wt. I.	135.5	1	18	1	6		1875	
195	Ferry st., across harbor	Highway.	Plate girder, swing	Wt. I.	118.2	1	16.9				1869	$6,612.

196	York street, Buffalo......	High'y & change.	Lattice	Wt. I.	176.3	1	19.6	2	8	....	1880	$11,644.72.
196½	Hudson street, Buffalo...	Highway.	Lattice	Wt. I.	180	1	19	....	......	1° 30′ R	1888	$6,414.
197	Georgia street, Buffalo...	Highway.	Whipple, arch....	C. I...	178.1	1	20.1	...	......	....	1871	$1,683.
198	Slip No. 3, Buffalo	Tow-path	Whipple, arch..................	C. I...	59	1	13.6	....	......	....	1880	G. V. canal.
199	Wilkinson slip, Buffalo ..	Tow-path	Arch, draw	W	25.2	1	11	....	......	....	....	Supt.
200	Genesee street, Buffalo ..	Highway.	Lattice	Wt. I,	171.8	1	19.6	2	6	8° 10′ R	1879	$5,575.
201	Slip No. 2, Buffalo	Tow-path	Whipple, arch.................	C. I...	59.10	1	13.6	....	......	....	1883	G. V. canal.
202	Slip No. 1, Buffalo	Tow-path	Bowstring......................	Wt. I.	86	1	14	....	......	18° 50′ L	1878	$745.
203	Erie street, Buffalo........	Tow-path	Whipple, arch..................	C. I...	90.9	3	19.10	2	19.3	9° R	1868	$10,042.50.
204	Commercial st., Buffalo..	Highway.	Lattice.........................	W.&I.	90	2	16	2	8.6	2° L	1881	$4,545.16.
205	Canal street, Commercial slip, Buffalo............	Highway.	Whipple, arch..................	C. I...	85.10	2	17	2	7.6	4° 25′ R	1849	
206	Prime street, Commercial slip, Buffalo............	Highway.	Whipple, arch..................	C. I...	87	2	11.9	2	5.6	....	1849	$2,800.
207	Lloyd street, Buffalo	Highway.	Lattice.........................	Wt. I.	88.6	2	16	2	8.6	2° 20′ R	1881	$4,524.10.
208	Main street, Buffalo......	Highway.	Whipple, arch..................	C. I...	72	3	20.2	2	{ 17.6 19 }	....	1867	$10,000.
209	Washington st., Buffalo..	Highway.	Lattice.........................	Wt. I.	91.2	2	19	2	12	20° 30′ R	1873	$2,280.
210	Scott st., C. and S. canal, Buffalo	Highway.	Whipple, arch..................	C. I...	81	1	19	2	7	... .	1869	$3,354.
211	Perry st., C. and S. canal, Buffalo	Highway.	Whipple, arch..................	C. I...	65	2	19	2	7	....	1855	$2,485.
212	Elk st., C. and S. canal, Buffalo	Highway.	Bollman, truss.................	C. I...	55.6	2	20	2	8	....	1868	$3,600.
213	Ohio st., C. and S. canal, Buffalo	Highway,	Bollman, truss.................	C. I...	58	2	19	2	7.4	19° 30′ R	1868	$2,938.39.
214	Michigan street, Buffalo.	Highway.	Whipple, arch..................	C. I...	89.6	2	18.2	2	12.4	....	1864	$5,575.
215	Chicago street, Buffalo...	Highway.	Whipple, arch..................	C. I...	89.6	2	19.1	2	7	....	1851	$6,400.
216	Louisiana street, Buffalo.	Highway.	Lattice.........................	Wt. I.	91	2	17	2	7.3	....	1885	$3,825.
217	Perry street, Ohio slip, Buffalo	Highway.	Whipple, arch..................	C. I...	59	2	16	2	7	....	1858	$1,888.
218	Fulton street, Ohio slip, Buffalo	Highway.	Whipple, arch..................	C. I...	61.9	1	19	2	6	....	1871	$2,214.16.
219	Elk st., Ohio slip, Buffalo.	Highway.	Bowstring...........	Wt. I.	59.5	2	18.6	2	7	....	1870	$2,399.28.
220	Ohio st., Ohio slip, Buffalo	Highway.	Lattice, swing	Wt. I.	41.6	1	18.9	....	......	....	1873	$3,600.

ELEVATION OF BRIDGES FROM GUARD LOCK, BLACK ROCK, THROUGH BUFFALO, ABOVE MEAN LOW WATER, LAKE ERIE.

NAMES OF BRIDGES.	LOWEST ELEVATION.		Proper elevation.	ABOVE.		BELOW.		Remarks.
	End.	Middle.		End.	Middle.	End.	Middle.	
Hamilton street	585.51	585.91	*585.25	0.26	0.66	....	....	Black Rock.
Amherst street	584.83	585.07	....	....	....	0.42	0.18	Erie canal.
Mill street	584.07	585.84	....	....	0.59	1.18	....	Erie canal.
International railroad	585.70	....	....	0.45	....	....	....	Erie canal.
Ferry street	584.73	585.06	....	....	....	0.52	0.10	Erie canal.
New York Central railroad	589.57	589.75	....	4.32	4.50	....	....	Erie canal.
York street	587.07	587.11	....	1.82	1.86	....	....	Erie canal.
Georgia street	586.58	587.35	....	1.33	2.10	....	....	Erie canal.
Tow-path	585.09	....	....	....	....	0.16	....	Slip No. 3.
New York Central railroad	585.07	585.16	....	....	....	0.18	0.09	Slip No. 3.
New York Central railroad	586.69	586.76	....	1.44	1.51	....	....	Slip No. 3.
Genesee street	586.41	586.46	....	1.16	1.21	....	....	Erie canal.
Tow-path	587.48	....	....	2.23	....	....	....	Slip No. 2.
New York Central railroad	585.55	585.57	....	0.30	0.32	....	....	Slip No. 2.
Grand Trunk railroad	586.40	586.36	....	1.15	1.11	....	....	Slip No. 2.
River street	585.50	585.55	....	0.25	0.30	....	....	Slip No. 2.
Tow-path	584.78	585.21	....	....	....	0.47	0.04	Slip No. 1.
New York Central railroad (wooden)	584.28	584.18	....	....	....	0.97	1.07	Slip No. 1.
New York Central railroad (iron)	585.08	585.15	....	....	....	0.17	0.10	Slip No. 1.
River street (city bridge)	584.19	584.29	....	....	....	1.06	0.96	Slip No. 1.
Erie street	585.55	585.92	....	0.30	0.67	....	....	Erie canal.
Evans street (city bridge)	585.88	585.94	....	0.63	0.69	....	....	Erie canal.
Commercial street	587.87	587.92	....	2.62	2.67	....	....	Erie canal.
Canal street	585.52	586.27	....	0.27	1.02	....	....	Commercial slip.
Delaware and Lackawanna railroad	586.61	586.66	....	1.36	1.41	....	....	Commercial slip.
Prime street	585.61	586.53	....	0.36	1.28	....	....	Commercial slip.
Lloyd street	588.07	588.17	....	2.82	2.92	....	....	Hamburgh canal.
Main street	586.06	586.84	....	0.81	1.59	....	....	Hamburgh canal.
Washington street	586.06	586.21	....	0.81	0.96	....	....	Hamburgh canal.
Michigan street	585.82	586.77	....	0.57	1.52	....	....	Hamburgh canal.
Chicago street	584.93	585.63	....	....	0.38	0.32	....	Hamburgh canal.
New York Central railroad	584.94	584.94	....	....	....	0.31	0.31	Hamburgh canal.
Louisiana street	585.14	585.13	....	....	....	0.11	0.12	Hamburgh canal.
Delaware and Lackawanna railroad	586.48	586.64	....	1.23	1.39	....	....	Clark & Skinner canal.
Elk street	584.52	584.52	....	....	....	0.73	0.73	Clark & Skinner canal.
Ohio street	585.48	585.53	....	0.23	0.28	....	....	Clark & Skinner canal.
Perry street	585.30	585.64	....	0.05	0.39	....	....	Clark & Skinner canal.

Scott street	585.49	586.14	....	0.24	0.89	....	....	Clark & Skinner canal.
Lehigh Valley railroad	585.16	....	....	....	....	0.09	....	Clark & Skinner canal.
Lehigh Valley railroad	585.20	585.15	....	....	....	0.05	0.10	Ohio slip.
Perry street	585.18	585.47	....	....	0.22	0.07	....	Ohio slip.
Fulton street	585.46	586.00	....	0.21	0.75	....	....	Ohio slip.
Elk street	585.10	585.10	....	....	....	0.15	0.15	Ohio slip.

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* This is thirteen feet above mean low water in Lake Erie, which is 572.23 + tide water, as per United States engineers.

WESTERN DIVISION — ERIE CANAL.

List of benches showing elevation, canal bottom and above tide-water. T. W., mean low tide.

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
1	Station 0, on north-west corner buttress, east wing, tow-path abutment, Wayne county line bridge, No. 1, marked [] with chisel	+11.904	+396.978
2	Station 134.33, on north-west corner coping buttress, west wing, tow-path abutment, Pitt lock bridge, No. 2, marked [] with chisel	11.865	396.939
3	Station 320.96, on north-west corner coping buttress, west wing, tow-path abutment, Waldruff's bridge, No 3, marked [] with chisel	12.040	397.114
4	Station 516.55, north-east corner coping, berme abutment, Glasgow street bridge, No. 4, Clyde, marked [] with chisel	13.798	398.872
5	Station 616.84, east berme, hollow quoin, lock 53, Clyde, marked [] with chisel	13.960	399.034
6	Station 13.80, west wing, berme, Sigeman's bridge, No. 6, marked [] with chisel	11.696	401.525
7	Station 78.14, east wing, tow-path, Barker's farm bridge, No. 7, marked [] with chisel	11.633	401.462
8	Station 131.10, on east wing berme, Long's farm bridge, No. 8, marked [] with chisel	12.434	402.263
9	Station 194.73, on Dive culvert parapet wall, tow-path, marked [] with chisel	4.022	393.851
10	Station 208, west abutment, waste-weir, berme, marked [] with chisel	9.088	398.917
11	Station 230.10, center of Dive culvert parapet, tow-path, marked [] with chisel	4.001	393.830
12	Station 252.60, on east berme, hollow-quoin, lock, Berlin lock, No. 54, marked [] with chisel	16.451	406.280
13	Station 32+48, on east wing, berme, Horton's bridge, No. 10, marked [] with chisel	+11.537	408.726
14	Station 70+50, on east wing, berme, Goetzman's farm bridge, No. 11, marked [] with chisel	12.409	409.598
15	Station 125+20, west wing, tow-path, Klaus' highway bridge, No. 12, marked [] with chisel	11.657	408.846

16	Station 152+96, on west wing, berme, Richmond's farm bridge, No. 13, marked [] with chisel	+11.520	408.709
17	Station 177+32, on west wing, tow-path, Cole's highway bridge, No. 14, marked [] with chisel	11.448	408.637
18	Station 197+60, on center of arch culvert parapet, tow-path, marked [] with chisel	5.234	402.423
19	Station 245 +45, on west wing, tow-path, Geneva street bridge, No. 15, Lyons, marked [] with chisel	12.269	409.458
20	Station 258+93, on second lower step, east wing, tow-path, Water street bridge, No. 17, Lyons, marked [] with chisel	10.354	407.543
21	Station 267+79, on east berme, hollow quoin, lock 55, Lyons, marked [] with chisel	14.925	412.114
22	Station 34+88, on west wing buttress, Mud creek aqueduct, marked [] with chisel	9.111	412.551
23	Station 99+40, west wing, berme, Prime's farm bridge, No. 19, marked [] with chisel	12.241	415.681
24	Station 130+94, on east wing, tow-path, Park's highway bridge, No. 20, marked [] with chisel	13.111	416.551
25	Station 136+39, on east berme, hollow quoin, lock 56, poor-house, marked [] with chisel	18.975	422.415
26	Station 41+10, on Dive culvert parapet, tow-path, marked [] with chisel	3.665	416.953
27	Station 78+42, on west wing, tow-path, Mosher's highway bridge, No. 21, marked [] with chisel	11.588	424.876
28	Station 100+05, on Dive culvert parapet, tow-path, marked [] with chisel	3.444	416.732
29	Station 152+25, on lower step, east end, New York Central railroad bridge abutment, tow-path, marked [] with chisel	11.336	424.624
30	Station 165+79, on west wing, change bridge, No. 22, tow-path, marked [] with chisel	12.230	425.518
31	Station 212+15, on center Dive culvert parapet, tow-path, marked [] with chisel.	4.220	417.508
32	Station 252+68, on east berme, hollow quoin, lower Lockville lock, 57, marked [] with chisel	16.525	429.813

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation. above T. W.
33	Station 14+38, on east berme, hollow quoin, middle Lockville lock, 58, marked [] with chisel	16.855	438.171
34	Station 12+59, on east berme, hollow quoin, upper Lockville lock, 59, marked [] with chisel	16.723	446.043
35	Station 39+08, on east wing, tow-path abutment, Charles street bridge, No. 24, Newark, marked [] with chisel	10.262	447.584
36	Station 50+08, on west wing, tow-path, Main street bridge, No. 25, Newark, marked [] with chisel	11.077	448.399
37	Station 66+17, on coping, west abutment, tow-path, Newark waste-weir, marked [] with chisel	9.100	446.422
38	Station 141+82, on east wing, tow-path, Allerton's highway bridge, No. 26, marked [] with chisel	11.764	449.086
39	Station 189+40, on west wing, tow-path, Peck's bridge, No. 27, marked [] with chisel	11.231	448.553
40	Station 244+63, on west wing, tow-path, Sweezey's farm bridge, No. 28, marked [] with chisel	+12.010	449.332
41	Station 280+52, on east wing, tow-path, Palmer's farm bridge, No. 29, marked [] with chisel	11.625	448.947
42	Station 322+37, on third lower step, west wing, tow-path, Port Gibson bridge, No. 30, marked [] with chisel	11.420	448.742
43	Station 527+50, on lower step, east wing, tow-path, Galloway's highway bridge, No. 31, marked [] with chisel	11.896	449.218
44	Station 664, on center of culvert parapet, tow-path, marked [] with chisel	—3.078	434.244
45	Station 708+15, on west wing, berme, Railroad avenue bridge, No. 32, Palmyra, marked [] with chisel	+13.560	450.882
46	Station 749+97, on lower step, east wing, tow-path, Church street bridge, No. 34, Palmyra, marked [] with chisel	9.941	447.263

47	Station 805+35, on east wing, north side, tow-path, change bridge, No. 35, marked [] with chisel	10.934	448.256
48	Station 817+50, on buttress west wing, tow-path, east abutment, mud creek aqueduct, marked [] with chisel	8.926	446.248
49	Station 853, on east wing, tow-path, Crandall's highway bridge, No. 36, marked [] with chisel	12.339	449.661
50	Station 880, on lower step, east wing, tow-path, Clark's farm bridge, No. 37, marked [] with chisel	12.690	450.012
51	Station 947+76, on lower step, east wing, tow-path, White's highway bridge, No. 38, marked [] with chisel	+11.811	449.133
52	Station 969+69, on east berme, hollow quoin, lock 60, Macedon, marked [] with chisel	18.593	455.915
53	Station 33+13, on east wing, north side, change and road bridge, No. 39, marked [] with chisel	11.454	458.827
54	Station 66+20, on east berme, hollow quoin, Upper Macedon, lock 61, marked [] with chisel	15.683	463.056
55	Station 12+86, by lower broken step, west wing, tow-path, Macedon highway bridge, No. 40, marked [] with chisel	13.733	467.707
56	Station 94, on west wing, tow-path, Frear's highway bridge, No. 41, marked [] with chisel	11.546	465.520
57	Station 266+45, on west wing, tow-path, Wayneport highway bridge, No. 42, marked [] with chisel	10.991	464.965
58	Station 452+10, on east wing, tow-path, Knappville bridge, No. 43, marked [] with chisel	13.055	467.029
59	Station 533+40, on center parapet coping, tow-path, Thomas creek culvert, marked [] with chisel	6.796	460.770
60	Station 585+95, on east wing, tow-path, Baker's bridge, No. 44, marked [] with chisel	13.034	467.008
61	Station 625+98, on east wall, parapet, tow-path, waste-weir, marked [] with chisel.	11.741	465.715
62	Station 635+52, on west wing, tow-path, Main street bridge, No. 46, Fairport, marked [] with chisel	12.458	466.432

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
63	Station 713+25, on east wing, tow-path, Fullam basin bridge, No. 47, marked [] with chisel	+11.525	465.499
64	Station 830+60, on north-west corner culvert parapet, tow-path, marked [] with chisel	— 0.816	453.158
65	Station 835+83, on east wing, tow-path, Wapping bridge, No. 48, marked [] with chisel	+10.154	464.128
66	Station 863+15, on east wing, berme, Wiltsie's farm bridge, No. 49, marked [] with chisel	11.430	465.404
67	Station 924+20, on east end recess coping, tow-path, stop-gate, marked [] with chisel	10.176	464.150
68	Station 951+73, on east wing, tow-path, Bushnell's basin bridge, No. 50, marked [] with chisel	11.841	465.815
69	Station 1079+84, on west wing, tow-path, Cartersville bridge, No. 51, marked [] with chisel	12.000	465.820
70	Station 1093+67, on west abutment, tow-path, Cartersville waste-weir, marked [] with chisel	8.985	462.959
71	Station 1130+80, on lower step, west wing, tow-path, Guernsey's bridge, No. 52, marked [] with chisel	13.551	467.525
72	Station 1171+10, on east wing, tow-path, highway bridge, No. 53, Pittsford, marked [] with chisel	12.061	466.035
73	Station 1194+90, on east wing, tow-path, Main street bridge, No. 54, Pittsford, marked [] with chisel	12.021	465.995
74	Station 1230+67, on east wing, tow-path, Sutherland's bridge, No. 55, State road, marked [] with chisel	11.868	465.842
75	Station 1352+15, on east wing, tow-path, Cook's highway bridge, No. 56, marked [] with chisel	11.696	465.670

76	Station 1373+55, on east berme, hollow quoin, lock 62, Pittsford, marked [] with chisel	+17.922	471.896
77	Station 39+80, on east wing, tow-path, Weed's bridge, No. 57, marked [] with chisel	10.879	474.003
78	Station 79, on east wing, tow-path, Billinghurst's bridge, No. 58, marked [] with chisel	12.427	475.551
79	Station 99+70, on north-east wing, waste-weir, berme, marked [] with chisel	9.161	472.285
80	Station 141+47, on east wing, tow-path, Donnelly's bridge, No. 59, marked [] with chisel	12.348	475.472
81	Station 197+90, on east wing, tow-path, Drake's bridge, No. 60, marked [] with chisel	12.300	475.424
82	Station 227+98, on east berme, hollow quoin, Miller's lock, 63, Brighton, marked [] with chisel	17.730	480.854
83	Station 22+03, on east wing, tow-path, Brighton bridge, No. 61, marked [] with chisel	12.733	484.639
84	Station 42+62, on east berme, hollow quoin, lock 64 Sipple's (third east of Rochester), marked [] with chisel	18.907	490.813
85	Station 30+66, on east berme, hollow quoin, lock 65 (second east of Rochester), marked [] with chisel	18.864	500.878
86	Station 34+09, on east berme, hollow quoin, lock 66 (first east of Rochester), marked [] with chisel	18.081	510.197
87	Station 23+60, on east wing, tow-path, Goodman street bridge, No. 64, marked [] with chisel	13.018	513.175
88	Station 53+20, on west wing, tow-path, Averill street bridge, No. 66, marked [] with chisel	13.808	513.977
89	Station 60+88, on east wing, tow-path, Alexander street bridge, No. 67, marked [] with chisel	13.004	513.185
90	Station 93+38, on west wing, tow-path, Griffith street bridge, No. 69, marked [] with chisel	11.744	511.949
91	Station 102. on east end of weigh-lock pier, (near east snubbing post), marked [] with chisel	9.568	509.778

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* —(Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
92	Station 129, on west end, berme, Rochester aqueduct, marked [] with chisel.....	+ 8.595	509.812
93	Station 171+87, on third step, east end of abutment, Ford street bridge, No. 78, marked [] with chisel..........	12.330	512.574
94	Station 243+44, on first step, east end, Niagara Falls railroad bridge, marked [] with chisel..........	11.489	511.778
95	Station 308+50, on center-hollow quoin, stop-gate, tow-path, marked [] with chisel..........	8.805	508.838
96	Station 352+53, on lower step, east wing, tow-path, Rowe street bridge, No. 86, marked [] with chisel..........	13.128	513.485
97	Station 368+02, on east wing, south side, change bridge, No. 87, marked [] with chisel..........	11.347	511.713
98	Station 418+24, on east wing, tow path, Scott's bridge, No. 88, marked [] with chisel..........	12.596	512.993
99	Station 461+22, on east wing, tow path, four-mile grocery bridge, No. 89, marked [] with chisel..........	13.303	513.723
100	Station 618+60, on east wing, tow-path, Speir's bridge, No. 90, marked [] with chisel..........	13.083	513.595
101	Station 640+34, on east wing, tow-path, six-mile grocery bridge, No. 91, marked [] with chisel..........	13.231	513.755
102	Station 689+58, on west wing, tow-path, Douglas' farm bridge, No. 92, marked [] with chisel..........	11.510	512.063
103	Station 724+33, on arch culvert parapet, tow-path, marked [] with chisel........	+1.617	502.175
104	Station 766+85, on east wing, tow-path, eight-mile grocery bridge, No. 94, South Greece, marked [] with chisel..........	12.749	513.329
105	Station 855+20, on east wing, tow-path, Cromwell's bridge, No. 95, marked [] with chisel..........	13.292	513.945

106	Station 899, on arch culvert parapet, tow-path, marked [] with chisel	0.413	501.092
107	Station 940+63, on east wing, tow-path, Hiscock's bridge, No. 96, marked [] with chisel	12.028	512.732
108	Station 1013+17, on east wing, tow-path, Norman's farm bridge, No. 97, marked [] with chisel	12.121	512.869
109	Station 1033+90, on east abutment, berme, Spencerport waste-weir, marked [] with chisel	9.086	509.846
110	Station 1048+33, on arch culvert parapet, tow-path, marked [] with chisel	1.143	501.911
111	Station 1073+45, on lower step, tow-path, west wing, Amity street bridge, No. 99, marked [] with chisel	12.312	513.094
112	Station 1115+56, on arch culvert parapet, tow-path, marked [] with chisel	— 0.172	500.629
113	Station 1164+60, on east wing, tow-path, Webster's east bridge, No. 100, marked [] with chisel	+13.435	514.270
114	Station 1182+42, on lower step, east wing, tow-path, Webster's west bridge, No. 101, marked [] with chisel	11.913	512.762
115	Station 1264+30, on west wing, tow-path, Cressy's bridge, No. 102, marked [] with chisel	+12.791	513.689
116	Station 1291+35, on east wing, tow-path, Adams basin bridge, No. 103, marked [] with chisel	12.405	513.319
117	Station 1309.62, on east end of parapet, tow-path, Salmon creek culvert, marked [] with chisel	1.225	502.150
118	Station 1355.51, on center stop-gate, Adams basin (2′ east hollow quoin on pier), marked [] with chisel	8.592	509.545
119	Station 1377, on east wing, berme, Doty's bridge, No. 104, marked [] with chisel	13.754	514.720
120	Station 1413+66, on west end of Dive culvert, parapet, marked [] with chisel	6.859	507.847
121	Station 1461+55, on lower course, west wing, tow-path, Brockway's bridge, No. 105, marked [] with chisel	11.252	512.245
122	Station 1486+85, on east wing, tow-path, Cooley's basin bridge, No. 106, marked [] with chisel	12.913	513.945
123	Station 1520+22, on west end, Dive culvert, parapet, marked [] with chisel (tow-path)	5.366	506.418

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
124	Station 1581+44, on arch Dive culvert parapet, tow-path, marked [] with chisel	+0.872	502.009
125	Station 1654+76, on lower step, east end, tow-path abutment, Mechanic street bridge, No. 107, marked [] with chisel (Brockport)	9.771	511.113
126	Station 1691+76, on lower step, east wing, tow-path, Smith street bridge, No. 109, Brockport, marked [] with chisel	11.816	512.971
127	Station 1693+50, on east pier, east abutment, Brockport waste-weir, marked [] with chisel	+9.182	510.338
128	Station 1840+82, on dive culvert parapet, tow-path, marked [] with chisel	2.063	503.307
129	Station 1899+43, on offset, east wing, tow-path, Miner's bridge, No. 111, marked [] with chisel	9.849	511.128
130	Station 1922+98, on arch culvert parapet, tow-path, marked [] with chisel	0.753	502.167
131	Station 1990+05, on east stop-gate abutment, tow-path, (east of Holley), marked [] with chisel	8.973	510.307
132	Station 1994+42, on west end, west wing, tow-path, Orr's bridge, No. 113, marked [] with chisel	14.597	515.934
133	Station 2005+15, on east abutment, Holley waste-weir, marked [] with chisel	10.291	511.634
134	Station 2011+70, on west abutment, Holley waste-weir, old canal, marked [] with chisel	10.339	511.686
135	Station 2031+50, on east wing, tow-path, Main street bridge, No. 115, Holley, marked [] with chisel	13.759	515.118
136	Station 2054+20, on west wing, arch culvert parapet, tow-path, marked [] with chisel.	1.464	502.836
137	Station 2085+32, on east wing, tow-path, McCarthy's bridge, No. 116, marked [] with chisel	14.011	515.402
138	Station 2107+15, on arch culvert, parapet, tow-path, marked [] with chisel	— 3.408	498.016
139	Station 2152+05, on east wing, tow-path, Tuttle's bridge, No. 117, marked [] with chisel	+14.253	515.675

140	Station 2168+78, on east end of abutments, tow-path, stop-gate west of Holley, marked □ with chisel	+11.025	512.466
141	Station 2191+54, on east wing, tow-path, McGuire's bridge, No. 118, marked □ with chisel	14.262	515.729
142	Station 2250+84, on dive culvert parapet, tow-path, marked □ with chisel	4.398	505.889
143	Station 2279+20, on bottom step, west side, tow-path, Hulburton bridge, No. 119, marked □ with chisel	13.302	514.815
144	Station 2302+80, on arch culvert parapet, tow-path, marked □ with chisel	1.364	502.886
145	Station 2369+92, on west wall, Brockville waste-weir, marked □ with chisel	10.391	511.953
146	Station 2384+46, on east wing, tow-path, Brockville bridge, No. 120, marked □ with chisel	14.297	515.868
147	Station 2445+50 on east wing, tow-path, Hindsburgh bridge, No. 121, marked □ with chisel	14.503	516.110
148	Sitation 2554+93, on west wing, tow-path, dive culvert parapet, marked □ with chisel	0.950	502.623
149	Stations 2567+27, on east wings, tow-path, Jaquith's bridge, No. 123, marked □ with chisel	14.647	516.327
150	Station 2615+60, near east end parapet, tow-path, arch culvert, marked □ with chisel	1.386	503.095
151	Station 2623+63, on east end, east wing, tow-path, Bidwell's bridge, No. 124, marked □ with chisel	+13.456	515.170
152	Station 2688+50, on arch culvert parapet, near east end, tow-path, marked □ with chisel	1.142	502.895
153	Station 2742+44, on west wing, tow-path, Hall's bridge, No. 126, marked □ with chisel	14.333	516.198
154	Station 2764+70, on west wall, Albion waste-weir, marked □ with chisel	10.412	512.211
155	Station 2791+15, on lower step, east wing, tow-path, Ingersoll street bridge, No. 127, Albion, marked □ with chisel	11.142	512.957
156	Station 2804+40, on northwest corner of center pier, coping, swing-bridge, Albion, marked □ with chisel	7.930	509.753

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. B.
157	Station 2820+13, on west end, parapet, tow-path, Dive culvert, marked [] with chisel	4.808	506.640
158	Station 2892+20, on east wing, tow-path, Lattin's bridge, No. 129, marked [] with chisel	13.902	515.777
159	Station 2918+45, on west end of Dive culvert parapet, tow-path, marked [] with chisel	4.932	506.823
160	Station 2941+63, on lower step, west wing, tow-path, Gaines' basin bridge, No. 130, marked [] with chisel	12.115	514.020
161	Station 2980+44, on Dive culvert parapet, three feet from east end, tow-path, marked [] with chisel	5.508	507.412
162	Station 3041+70, on west abutment, tow-path, Eagle harbor waste-weir, marked [] with chisel	....	....
163	Station 3065+30, on lower step, east wing, tow-path, Eagle Harbor bridge, No. 131, marked [] with chisel	+13.016	514.995
164	Station 3102+50, on east wing, tow-path, Starkweather's farm bridge, No. 132, marked [] with chisel	14.143	516.145
165	Station 3125+60, on east wing, tow-path, Allen's bridge, No. 133, marked [] with chisel	14.073	516.088
166	Station 3164+70, on east wing, tow-path, Long's bridge, No. 134, marked [] with chisel	14.014	516.053
167	Station 3264+03, on center of Dive culvert parapet, tow-path, marked [] with chisel	7.759	509.857
168	Station 3310+06, on second lower step, west end, tow-path, Knowlesville bridge, No. 135, marked [] with chisel	13.742	515.868
169	Station 3388+85, on east end, Dive culvert parapet, marked [] with chisel	1.511	503.684
170	Station 3437+60, on east pilaster, road arch culvert parapet, tow-path, marked [] with chisel	2.101	504.303

171	Station 3446+97, on east end of abutment, tow-path, Knowlesville stop-gate, marked [] with chisel	10.614	512.822
172	Station 3499+25, on east wing, tow-path, Beal's bridge, No. 136, marked [] with chisel	12.135	514.375
173	Station 3562+93, on west wing, tow-path, Hasting's bridge, No. 137, marked [] with chisel	+13.330	515.607
174	Station 3613+50, on east wing, tow-path, Holloway's bridge, No. 138, marked [] with chisel	12.687	514.995
175	Station 3633+78, on north-west corner, west buttress, Medina aqueduct, marked [] with chisel	10.527	512.847
176	Station 3638+50, on east abutment, waste-weir, Medina, marked [] with chisel, berme	10.482	512.805
177	Station 3638+50, on west abutment, waste-weir, Medina, marked [] with chisel	10.405	512.728
178	Station 3644+28, on east wing, tow-path, Church street bridge, No. 139, Medina, marked [] with chisel	12.181	514.508
179	Station 3680, on lower step, east end, berme, Prospect street bridge, Medina, No. 140½, marked [] with chisel	14.172	516.520
180	Station 3701+93, on east end, old stop-gate abutment, marked [] with chisel	11.071	513.432
181	Station 3739+87, on Dive culvert parapet, tow-path, marked [] with chisel	8.291	510.675
182	Station 3801+18, on west wing, tow-path, Jackson's bridge, No. 141, marked [] with chisel	12.921	515.342
183	Station 3854+63, on east wing, tow-path, Shelby basin bridge, No. 142, marked [] with chisel	14.512	516.965
184	Station 3914+07, on east wing, tow-path, Gorman's bridge, No. 143, marked [] with chisel	+14.394	516.882
185	Station 3934+32, on west wing, tow-path, Coon's bridge, No. , marked [] with chisel	....	....
186	Station 4016+72, on center of dive culvert parapet, tow-path, marked [] with chisel.	8.172	510.722
187	Station 4051+12, on lower step, west wing, tow-path, Main street bridge, No. 145, Middleport, marked [] with chisel	12.295	514.872
188	Station 4075+65, on Middleport waste-weir, east abutment, marked [] with chisel.	10.880	513.465

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation. above T. W.
33	Station 14+38, on east berme, hollow quoin, middle Lockville lock, 58, marked [] with chisel	16.855	438.171
34	Station 12+59, on east berme, hollow quoin, upper Lockville lock, 59, marked [] with chisel	16.723	446.043
35	Station 39+08, on east wing, tow-path abutment, Charles street bridge, No. 24, Newark, marked [] with chisel	10.262	447.584
36	Station 50+08, on west wing, tow-path, Main street bridge, No. 25, Newark, marked [] with chisel	11.077	448.399
37	Station 66+17, on coping, west abutment, tow-path, Newark waste-weir, marked [] with chisel	9.100	446.422
38	Station 141+82, on east wing, tow-path, Allerton's highway bridge, No. 26, marked [] with chisel	11.764	449.086
39	Station 189+40, on west wing, tow-path, Peck's bridge, No. 27, marked [] with chisel	11.231	448.553
40	Station 244+63, on west wing, tow-path, Sweezey's farm bridge, No. 28, marked [] with chisel	+12.010	449.332
41	Station 280+52, on east wing, tow-path, Palmer's farm bridge, No. 29, marked [] with chisel	11.625	448.947
42	Station 322+37, on third lower step, west wing, tow-path, Port Gibson bridge, No. 30, marked [] with chisel	11.420	448.742
43	Station 527+50, on lower step, east wing, tow-path, Galloway's highway bridge, No. 31, marked [] with chisel	11.896	449.218
44	Station 664, on center of culvert parapet, tow-path, marked [] with chisel	—3.078	434.244
45	Station 708+15, on west wing, berme, Railroad avenue bridge, No. 32, Palmyra, marked [] with chisel	+13.560	450.882
46	Station 749+97, on lower step, east wing, tow-path, Church street bridge, No. 34, Palmyra, marked [] with chisel	9.941	447.263

47	Station 805+35, on east wing, north side, tow-path, change bridge, No. 35, marked [] with chisel	10.934	448.256
48	Station 817+50, on buttress west wing, tow-path, east abutment, mud creek aqueduct, marked [] with chisel	8.926	446.248
49	Station 853, on east wing, tow-path, Crandall's highway bridge, No. 36, marked [] with chisel	12.339	449.661
50	Station 880, on lower step, east wing, tow-path, Clark's farm bridge, No. 37, marked [] with chisel	12.690	450.012
51	Station 947+76, on lower step, east wing, tow-path, White's highway bridge, No. 38, marked [] with chisel	+11.811	449.133
52	Station 969+69, on east berme, hollow quoin, lock 60, Macedon, marked [] with chisel	18.593	455.915
53	Station 33+13, on east wing, north side, change and road bridge, No. 39, marked [] with chisel	11.454	458.827
54	Station 66+20, on east berme, hollow quoin, Upper Macedon, lock 61, marked [] with chisel	15.683	463.056
55	Station 12+86, by lower broken step, west wing, tow-path, Macedon highway bridge, No. 40, marked [] with chisel	13.733	467.707
56	Station 94, on west wing, tow-path, Frear's highway bridge, No. 41, marked [] with chisel	11.546	465.520
57	Station 266+45, on west wing, tow-path, Wayneport highway bridge, No. 42, marked [] with chisel	10.991	464.965
58	Station 452+10, on east wing, tow-path, Knappville bridge, No. 43, marked [] with chisel	13.055	467.029
59	Station 533+40, on center parapet coping, tow-path, Thomas creek culvert, marked [] with chisel	6.796	460.770
60	Station 585+95, on east wing, tow-path, Baker's bridge, No. 44, marked [] with chisel	13.034	467.008
61	Station 625+98, on east wall, parapet, tow-path, waste-weir, marked [] with chisel.	11.741	465.715
62	Station 635+52, on west wing, tow-path, Main street bridge, No. 46, Fairport, marked [] with chisel	12.458	466.432

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
63	Station 713+25, on east wing, tow-path, Fullam basin bridge, No. 47, marked [] with chisel	+11.525	465.499
64	Station 830+60, on north-west corner culvert parapet, tow-path, marked [] with chisel	— 0.816	453.158
65	Station 835+83, on east wing, tow-path, Wapping bridge, No. 48, marked [] with chisel	+10.154	464.128
66	Station 863+15, on east wing, berme, Wiltsie's farm bridge, No. 49, marked [] with chisel	11.430	465.404
67	Station 924+20, on east end recess coping, tow-path, stop-gate, marked [] with chisel	10.176	464.150
68	Station 951+73, on east wing, tow-path, Bushnell's basin bridge, No. 50, marked [] with chisel	11.841	465.815
69	Station 1079+84, on west wing, tow-path, Cartersville bridge, No. 51, marked [] with chisel	12.000	465.820
70	Station 1093+67, on west abutment, tow-path, Cartersville waste-weir, marked [] with chisel	8.985	462.950
71	Station 1130+80, on lower step, west wing, tow-path, Guernsey's bridge, No. 52, marked [] with chisel	13.551	467.525
72	Station 1171+10, on east wing, tow-path, highway bridge, No. 53, Pittsford, marked [] with chisel	12.061	466.085
73	Station 1194+90, on east wing, tow-path, Main street bridge, No. 54, Pittsford, marked [] with chisel	12.021	465.995
74	Station 1230+67, on east wing, tow-path, Sutherland's bridge, No. 55, State road, marked [] with chisel	11.868	465.842
75	Station 1352+15, on east wing, tow-path, Cook's highway bridge, No. 56, marked [] with chisel	11.696	465.670

76	Station 1373+55, on east berme, hollow quoin, lock 62, Pittsford, marked [] with chisel	+17.922	471.896
77	Station 39+80, on east wing, tow-path, Weed's bridge, No. 57, marked [] with chisel	10.879	474.003
78	Station 79, on east wing, tow-path, Billinghurst's bridge, No. 58, marked [] with chisel	12.427	475.551
79	Station 99+70, on north-east wing, waste-weir, berme, marked [] with chisel	9.161	472.285
80	Station 141+47, on east wing, tow-path, Donnelly's bridge, No. 59, marked [] with chisel	12.348	475.472
81	Station 197+90, on east wing, tow-path, Drake's bridge, No. 60, marked [] with chisel	12.300	475.424
82	Station 227+98, on east berme, hollow quoin, Miller's lock, 63, Brighton, marked [] with chisel	17.730	480.854
83	Station 22+03, on east wing, tow-path, Brighton bridge, No. 61, marked [] with chisel	12.733	484.639
84	Station 42+62, on east berme, hollow quoin, lock 64 Sipple's (third east of Rochester), marked [] with chisel	18.907	490.813
85	Station 30+66, on east berme, hollow quoin, lock 65 (second east of Rochester), marked [] with chisel	18.864	500.878
86	Station 34+09, on east berme, hollow quoin, lock 66 (first east of Rochester), marked [] with chisel	18.081	510.197
87	Station 23+60, on east wing, tow-path, Goodman street bridge, No. 64, marked [] with chisel	13.018	513.175
88	Station 53+20, on west wing, tow-path, Averill street bridge, No. 66, marked [] with chisel	13.808	513.977
89	Station 60+88, on east wing, tow-path, Alexander street bridge, No. 67, marked [] with chisel	13.004	513.185
90	Station 93+38, on west wing, tow-path, Griffith street bridge, No. 69, marked [] with chisel	11.744	511.949
91	Station 102. on east end of weigh-lock pier, (near east snubbing post), marked [] with chisel	9.568	509.778

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* —(Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
92	Station 129, on west end, berme, Rochester aqueduct, marked [] with chisel	+ 8.595	509.812
93	Station 171+87, on third step, east end of abutment, Ford street bridge, No. 78, marked [] with chisel	12.330	512.574
94	Station 243+44, on first step, east end, Niagara Falls railroad bridge, marked [] with chisel	11.489	511.778
95	Station 308+50, on center-hollow quoin, stop-gate, tow-path, marked [] with chisel	8.805	508.838
96	Station 352+53, on lower step, east wing, tow-path, Rowe street bridge, No. 86, marked [] with chisel	13.128	513.485
97	Station 368+02, on east wing, south side, change bridge, No. 87, marked [] with chisel	11.347	511.713
98	Station 418+24, on east wing, tow path, Scott's bridge, No. 88, marked [] with chisel	12.596	512.993
99	Station 461+22, on east wing, tow path, four-mile grocery bridge, No. 89, marked [] with chisel	13.303	513.723
100	Station 618+60, on east wing, tow-path, Speir's bridge, No. 90, marked [] with chisel	13.083	513.595
101	Station 640+34, on east wing, tow-path, six-mile grocery bridge, No. 91, marked [] with chisel	13.231	513.755
102	Station 689+58, on west wing, tow-path, Douglas' farm bridge, No. 92, marked [] with chisel	11.510	512.063
103	Station 724+33, on arch culvert parapet, tow-path, marked [] with chisel	+1.617	502.175
104	Station 766+85, on east wing, tow-path, eight-mile grocery bridge, No. 94, South Greece, marked [] with chisel	12.749	513.329
105	Station 855+20, on east wing, tow-path, Cromwell's bridge, No. 95, marked [] with chisel	13.292	513.945

106	Station 899, on arch culvert parapet, tow-path, marked [] with chisel	0.413	501.092
107	Station 940+63, on east wing, tow-path, Hiscock's bridge, No. 96, marked [] with chisel	12.028	512.732
108	Station 1013+17, on east wing, tow-path, Norman's farm bridge, No. 97, marked [] with chisel	12.121	512.869
109	Station 1033+90, on east abutment, berme, Spencerport waste-weir, marked [] with chisel	9.086	509.846
110	Station 1048+33, on arch culvert parapet, tow-path, marked [] with chisel	1.143	501.911
111	Station 1073+45, on lower step, tow-path, west wing, Amity street bridge, No. 99, marked [] with chisel	12.312	513.094
112	Station 1115+56, on arch culvert parapet, tow-path, marked [] with chisel	— 0.172	500.629
113	Station 1164+60, on east wing, tow-path, Webster's east bridge, No. 100, marked [] with chisel	+13.435	514.270
114	Station 1182+42, on lower step, east wing, tow-path, Webster's west bridge, No. 101, marked [] with chisel	11.913	512.762
115	Station 1264+30, on west wing, tow-path, Cressy's bridge, No. 102, marked [] with chisel	+12.791	513.689
116	Station 1291+35, on east wing, tow-path, Adams basin bridge, No. 103, marked [] with chisel	12.405	513.319
117	Station 1309.62, on east end of parapet, tow-path, Salmon creek culvert, marked [] with chisel	1.225	502.150
118	Station 1355.51, on center stop-gate, Adams basin (2′ east hollow quoin on pier), marked [] with chisel	8.592	509.545
119	Station 1377, on east wing, berme, Doty's bridge, No. 104, marked [] with chisel	13.754	514.720
120	Station 1413+66, on west end of Dive culvert, parapet, marked [] with chisel	6.859	507.847
121	Station 1461+55, on lower course, west wing, tow-path, Brockway's bridge, No. 105, marked [] with chisel	11.252	512.245
122	Station 1486+85, on east wing, tow-path, Cooley's basin bridge, No. 106, marked [] with chisel	12.913	513.945
123	Station 1520+22, on west end, Dive culvert, parapet, marked [] with chisel (tow-path)	5.366	506.418

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
124	Station 1581+44, on arch Dive culvert parapet, tow-path, marked [] with chisel	+0.872	502.009
125	Station 1654+76, on lower step, east end, tow-path abutment, Mechanic street bridge, No. 107, marked [] with chisel (Brockport)	9.771	511.113
126	Station 1691+76, on lower step, east wing, tow-path, Smith street bridge, No. 109, Brockport, marked [] with chisel	11.816	512.971
127	Station 1693+50, on east pier, east abutment, Brockport waste-weir, marked [] with chisel	+9.182	510.338
128	Station 1840+82, on dive culvert parapet, tow-path, marked [] with chisel	2.063	503.307
129	Station 1899+43, on offset, east wing, tow-path, Miner's bridge, No. 111, marked [] with chisel	9.849	511.128
130	Station 1922+98, on arch culvert parapet, tow-path, marked [] with chisel	0.753	502.167
131	Station 1990+05, on east stop-gate abutment, tow-path, (east of Holley), marked [] with chisel	8.973	510.307
132	Station 1994+42, on west end, west wing, tow-path, Orr's bridge, No. 113, marked [] with chisel	14.597	515.934
133	Station 2005+15, on east abutment, Holley waste-weir, marked [] with chisel	10.291	511.634
134	Station 2011+70, on west abutment, Holley waste-weir, old canal, marked [] with chisel	10.339	511.686
135	Station 2031+50, on east wing, tow-path, Main street bridge, No. 115, Holley, marked [] with chisel	13.759	515.118
136	Station 2054+20, on west wing, arch culvert parapet, tow-path, marked [] with chisel.	1.464	502.836
137	Station 2085+32, on east wing, tow-path, McCarthy's bridge, No. 116, marked [] with chisel	14.011	515.402
138	Station 2107+15, on arch culvert, parapet, tow-path, marked [] with chisel	— 3.408	498.016
139	Station 2152+05, on east wing, tow-path, Tuttle's bridge, No. 117, marked [] with chisel	+14.253	515.675

140	Station 2168+78, on east end of abutments, tow-path, stop-gate west of Holley, marked [] with chisel	+11.025	512.466
141	Station 2191+54, on east wing, tow-path, McGuire's bridge, No. 118, marked [] with chisel	14.262	515.729
142	Station 2250+84, on dive culvert parapet, tow-path, marked [] with chisel	4.398	505.889
143	Station 2279+20, on bottom step, west side, tow-path, Hulburton bridge, No. 119, marked [] with chisel	13.302	514.815
144	Station 2302+80, on arch culvert parapet, tow-path, marked [] with chisel	1.364	502.886
145	Station 2369+92, on west wall, Brockville waste-weir, marked [] with chisel	10.391	511.953
146	Station 2384+46, on east wing, tow-path, Brockville bridge, No. 120, marked [] with chisel	14.297	515.868
147	Station 2445+50 on east wing, tow-path, Hindsburgh bridge, No. 121, marked [] with chisel	14.503	516.110
148	Sitation 2554+93, on west wing, tow-path, dive culvert parapet, marked [] with chisel	0.950	502.623
149	Stations 2567+27, on east wings, tow-path, Jaquith's bridge, No. 123, marked [] with chisel	14.647	516.327
150	Station 2615+60, near east end parapet, tow-path, arch culvert, marked [] with chisel	1.386	503.095
151	Station 2623+63, on east end, east wing, tow-path, Bidwell's bridge, No. 124, marked [] with chisel	+13.456	515.170
152	Station 2688+50, on arch culvert parapet, near east end, tow-path, marked [] with chisel	1.142	502.895
153	Station 2742+44, on west wing, tow-path, Hall's bridge, No. 126, marked [] with chisel	14.333	516.198
154	Station 2764+70, on west wall, Albion waste-weir, marked [] with chisel	10.412	512.211
155	Station 2791+15, on lower step, east wing, tow-path, Ingersoll street bridge, No. 127, Albion, marked [] with chisel	11.142	512.957
156	Station 2804+40, on northwest corner of center pier, coping, swing-bridge, Albion, marked [] with chisel	7.930	509.753

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. B.
157	Station 2820+13, on west end, parapet, tow-path, Dive culvert, marked □ with chisel	4.808	506.640
158	Station 2892+20, on east wing, tow-path, Lattin's bridge, No. 129, marked □ with chisel	13.902	515.777
159	Station 2918+45, on west end of Dive culvert parapet, tow-path, marked □ with chisel	4.932	506.823
160	Station 2941+63, on lower step, west wing, tow-path, Gaines' basin bridge, No. 130, marked □ with chisel	12.115	514.020
161	Station 2980+44, on Dive culvert parapet, three feet from east end, tow-path, marked □ with chisel	5.508	507.412
162	Station 3041+70, on west abutment, tow-path, Eagle harbor waste-weir, marked □ with chisel	....	....
163	Station 3065+30, on lower step, east wing, tow-path, Eagle Harbor bridge, No. 131, marked □ with chisel	+13.016	514.995
164	Station 3102+50, on east wing, tow-path, Starkweather's farm bridge, No. 132, marked □ with chisel	14.143	516.145
165	Station 3125+60, on east wing, tow-path, Allen's bridge, No. 133, marked □ with chisel	14.073	516.088
166	Station 3164+70, on east wing, tow-path, Long's bridge, No. 134, marked □ with chisel	14.014	516.053
167	Station 3264+03, on center of Dive culvert parapet, tow-path, marked □ with chisel	7.759	509.857
168	Station 3310+06, on second lower step, west end, tow-path, Knowlesville bridge, No. 135, marked □ with chisel	13.742	515.868
169	Station 3388+85, on east end, Dive culvert parapet, marked □ with chisel	1.511	503.684
170	Station 3437+60, on east pilaster, road arch culvert parapet, tow-path, marked □ with chisel	2.101	504.303

171	Station 3446+97, on east end of abutment, tow-path, Knowlesville stop-gate, marked [] with chisel	10.614	512.822
172	Station 3499+25, on east wing, tow-path, Beal's bridge, No. 136, marked [] with chisel	12.135	514.375
173	Station 3562+93, on west wing, tow-path, Hasting's bridge, No. 137, marked [] with chisel	+13.330	515.607
174	Station 3613+50, on east wing, tow-path, Holloway's bridge, No. 138, marked [] with chisel	12.687	514.995
175	Station 3633+78, on north-west corner, west buttress, Medina aqueduct, marked [] with chisel	10.527	512.847
176	Station 3638+50, on east abutment, waste-weir, Medina, marked [] with chisel, berme	10.482	512.805
177	Station 3638+50, on west abutment, waste-weir, Medina, marked [] with chisel	10.405	512.728
178	Station 3644+28, on east wing, tow-path, Church street bridge, No. 139, Medina, marked [] with chisel	12.181	514.508
179	Station 3680, on lower step, east end, berme, Prospect street bridge, Medina, No. 140½, marked [] with chisel	14.172	516.520
180	Station 3701+93, on east end, old stop-gate abutment, marked [] with chisel	11.071	513.432
181	Station 3739+87, on Dive culvert parapet, tow-path, marked [] with chisel	8.291	510.675
182	Station 3801+18, on west wing, tow-path, Jackson's bridge, No. 141, marked [] with chisel	12.921	515.342
183	Station 3854+63, on east wing, tow-path, Shelby basin bridge, No. 142, marked [] with chisel	14.512	516.965
184	Station 3914+07, on east wing, tow-path, Gorman's bridge, No. 143, marked [] with chisel	+14.394	516.882
185	Station 3934+32, on west wing, tow-path, Coon's bridge, No. , marked [] with chisel	....	....
186	Station 4016+72, on center of dive culvert parapet, tow-path, marked [] with chisel.	8.172	510.722
187	Station 4051+12, on lower step, west wing, tow-path, Main street bridge, No. 145, Middleport, marked [] with chisel	12.295	514.872
188	Station 4075+65, on Middleport waste-weir, east abutment, marked [] with chisel.	10.880	513.465

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation. above T. W.
33	Station 14+38, on east berme, hollow quoin, middle Lockville lock, 58, marked [] with chisel	16.855	438.171
34	Station 12+59, on east berme, hollow quoin, upper Lockville lock, 59, marked [] with chisel	16.723	446.043
35	Station 39+08, on east wing, tow-path abutment, Charles street bridge, No. 24, Newark, marked [] with chisel	10.262	447.584
36	Station 50+08, on west wing, tow-path, Main street bridge, No. 25, Newark, marked [] with chisel	11.077	448.399
37	Station 66+17, on coping, west abutment, tow-path, Newark waste-weir, marked [] with chisel	9.100	446.422
38	Station 141+82, on east wing, tow-path, Allerton's highway bridge, No. 26, marked [] with chisel	11.764	449.086
39	Station 189+40, on west wing, tow-path, Peck's bridge, No. 27, marked [] with chisel	11.231	448.553
40	Station 244+63, on west wing, tow-path, Sweezey's farm bridge, No. 28, marked [] with chisel	+12.010	449.332
41	Station 280+52, on east wing, tow-path, Palmer's farm bridge, No. 29, marked [] with chisel	11.625	448.947
42	Station 322+37, on third lower step, west wing, tow-path, Port Gibson bridge, No. 30, marked [] with chisel	11.420	448.742
43	Station 527+50, on lower step, east wing, tow-path, Galloway's highway bridge, No. 31, marked [] with chisel	11.896	449.218
44	Station 664, on center of culvert parapet, tow-path, marked [] with chisel	—3.078	434.244
45	Station 708+15, on west wing, berme, Railroad avenue bridge, No. 32, Palmyra, marked [] with chisel	+13.560	450.882
46	Station 749+97, on lower step, east wing, tow-path, Church street bridge, No. 34, Palmyra, marked [] with chisel	9.941	447.263

47	Station 805+35, on east wing, north side, tow-path, change bridge, No. 35, marked [] with chisel	10.934	448.256
48	Station 817+50, on buttress west wing, tow-path, east abutment, mud creek aqueduct, marked [] with chisel	8.926	446.248
49	Station 853, on east wing, tow-path, Crandall's highway bridge, No. 36, marked [] with chisel	12.339	449.661
50	Station 880, on lower step, east wing, tow-path, Clark's farm bridge, No. 37, marked [] with chisel	12.690	450.012
51	Station 947+76, on lower step, east wing, tow-path, White's highway bridge, No. 38, marked [] with chisel	+11.811	449.133
52	Station 969+69, on east berme, hollow quoin, lock 60, Macedon, marked [] with chisel	18.593	455.915
53	Station 33+13, on east wing, north side, change and road bridge, No. 39, marked [] with chisel	11.454	458.827
54	Station 66+20, on east berme, hollow quoin, Upper Macedon, lock 61, marked [] with chisel	15.683	463.056
55	Station 12+86, by lower broken step, west wing, tow-path, Macedon highway bridge, No. 40, marked [] with chisel	13.733	467.707
56	Station 94, on west wing, tow-path, Frear's highway bridge, No. 41, marked [] with chisel	11.546	465.520
57	Station 266+45, on west wing, tow-path, Wayneport highway bridge, No. 42, marked [] with chisel	10.991	464.965
58	Station 452+10, on east wing, tow-path, Knappville bridge, No. 43, marked [] with chisel	13.055	467.029
59	Station 533+40, on center parapet coping, tow-path, Thomas creek culvert, marked [] with chisel	6.796	460.770
60	Station 585+95, on east wing, tow-path, Baker's bridge, No. 44, marked [] with chisel	13.034	467.008
61	Station 625+98, on east wall, parapet, tow-path, waste-weir, marked [] with chisel.	11.741	465.715
62	Station 635+52, on west wing, tow-path, Main street bridge, No. 46, Fairport, marked [] with chisel	12.458	466.432

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.*— (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
63	Station 713+25, on east wing, tow-path, Fullam basin bridge, No. 47, marked [] with chisel	+11.525	465.499
64	Station 830+60, on north-west corner culvert parapet, tow-path, marked [] with chisel	— 0.816	453.158
65	Station 835+83, on east wing, tow-path, Wapping bridge, No. 48, marked [] with chisel	+10.154	464.128
66	Station 863+15, on east wing, berme, Wiltsie's farm bridge, No. 49, marked [] with chisel	11.430	465.404
67	Station 924+20, on east end recess coping, tow-path, stop-gate, marked [] with chisel	10.176	464.150
68	Station 951+73, on east wing, tow-path, Bushnell's basin bridge, No. 50, marked [] with chisel	11.841	465.815
69	Station 1079+84, on west wing, tow-path, Cartersville bridge, No. 51, marked [] with chisel	12.000	465.820
70	Station 1093+67, on west abutment, tow-path, Cartersville waste-weir, marked [] with chisel	8.985	462.959
71	Station 1130+80, on lower step, west wing, tow-path, Guernsey's bridge, No. 52, marked [] with chisel	13.551	467.525
72	Station 1171+10, on east wing, tow-path, highway bridge, No. 53, Pittsford, marked [] with chisel	12.061	466.035
73	Station 1194+90, on east wing, tow-path, Main street bridge, No. 54, Pittsford, marked [] with chisel	12.021	465.995
74	Station 1230+67, on east wing, tow-path, Sutherland's bridge, No. 55, State road, marked [] with chisel	11.868	465.842
75	Station 1352+15, on east wing, tow-path, Cook's highway bridge, No. 56, marked [] with chisel	11.696	465.670

76	Station 1373+55, on east berme, hollow quoin, lock 62, Pittsford, marked [] with chisel	+17.922	471.896
77	Station 39+80, on east wing, tow-path, Weed's bridge, No. 57, marked [] with chisel	10.879	474.003
78	Station 79, on east wing, tow-path, Billinghurst's bridge, No. 58, marked [] with chisel	12.427	475.551
79	Station 99+70, on north-east wing, waste-weir, berme, marked [] with chisel	9.161	472.285
80	Station 141+47, on east wing, tow-path, Donnelly's bridge, No. 59, marked [] with chisel	12.348	475.472
81	Station 197+90, on east wing, tow-path, Drake's bridge, No. 60, marked [] with chisel	12.300	475.424
82	Station 227+98, on east berme, hollow quoin, Miller's lock, 63, Brighton, marked [] with chisel	17.730	480.854
83	Station 22+03, on east wing, tow-path, Brighton bridge, No. 61, marked [] with chisel	12.733	484.639
84	Station 42+62, on east berme, hollow quoin, lock 64 Sipple's (third east of Rochester), marked [] with chisel	18.907	490.813
85	Station 30+66, on east berme, hollow quoin, lock 65 (second east of Rochester), marked [] with chisel	18.864	500.878
86	Station 34+09, on east berme, hollow quoin, lock 66 (first east of Rochester), marked [] with chisel	18.081	510.197
87	Station 23+60, on east wing, tow-path, Goodman street bridge, No. 64, marked [] with chisel	13.018	513.175
88	Station 53+20, on west wing, tow-path, Averill street bridge, No. 66, marked [] with chisel	13.808	513.977
89	Station 60+88, on east wing, tow-path, Alexander street bridge, No. 67, marked [] with chisel	13.004	513.185
90	Station 93+38, on west wing, tow-path, Griffith street bridge, No. 69, marked [] with chisel	11.744	511.949
91	Station 102. on east end of weigh-lock pier, (near east snubbing post), marked [] with chisel	9.568	509.778

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* —(Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
92	Station 129, on west end, berme, Rochester aqueduct, marked [] with chisel	+ 8.595	509.812
93	Station 171+87, on third step, east end of abutment, Ford street bridge, No. 78, marked [] with chisel	12.330	512.574
94	Station 243+44, on first step, east end, Niagara Falls railroad bridge, marked [] with chisel	11.489	511.778
95	Station 308+50, on center-hollow quoin, stop-gate, tow-path, marked [] with chisel	8.805	508.838
96	Station 352+53, on lower step, east wing, tow-path, Rowe street bridge, No. 86, marked [] with chisel	13.128	513.485
97	Station 368+02, on east wing, south side, change bridge, No. 87, marked [] with chisel	11.347	511.713
98	Station 418+24, on east wing, tow path, Scott's bridge, No. 88, marked [] with chisel	12.596	512.993
99	Station 461+22, on east wing, tow path, four-mile grocery bridge, No. 89, marked [] with chisel	13.303	513.723
100	Station 618+60, on east wing, tow-path, Speir's bridge, No. 90, marked [] with chisel	13.083	513.595
101	Station 640+34, on east wing, tow-path, six-mile grocery bridge, No. 91, marked [] with chisel	13.231	513.755
102	Station 689+58, on west wing, tow-path, Douglas' farm bridge, No. 92, marked [] with chisel	11.510	512.063
103	Station 724+33, on arch culvert parapet, tow-path, marked [] with chisel	+1.617	502.175
104	Station 766+85, on east wing, tow-path, eight-mile grocery bridge, No. 94, South Greece, marked [] with chisel	12.749	513.329
105	Station 855+20, on east wing, tow-path, Cromwell's bridge, No. 95, marked [] with chisel	13.292	513.945

106	Station 899, on arch culvert parapet, tow-path, marked [] with chisel	0.413	501.092
107	Station 940+63, on east wing, tow-path, Hiscock's bridge, No. 96, marked [] with chisel	12.028	512.732
108	Station 1013+17, on east wing, tow-path, Norman's farm bridge, No. 97, marked [] with chisel	12.121	512.869
109	Station 1033+90, on east abutment, berme, Spencerport waste-weir, marked [] with chisel	9.086	509.846
110	Station 1048+33, on arch culvert parapet, tow-path, marked [] with chisel	1.143	501.911
111	Station 1073+45, on lower step, tow-path, west wing, Amity street bridge, No. 99, marked [] with chisel	12.312	513.094
112	Station 1115+56, on arch culvert parapet, tow-path, marked [] with chisel	— 0.172	500.629
113	Station 1164+60, on east wing, tow-path, Webster's east bridge, No. 100, marked [] with chisel	+13.435	514.270
114	Station 1182+42, on lower step, east wing, tow-path, Webster's west bridge, No. 101, marked [] with chisel	11.913	512.762
115	Station 1264+30, on west wing, tow-path, Cressy's bridge, No. 102, marked [] with chisel	+12.791	513.689
116	Station 1291+35, on east wing, tow-path, Adams basin bridge, No. 103, marked [] with chisel	12.405	513.319
117	Station 1309.62, on east end of parapet, tow-path, Salmon creek culvert, marked [] with chisel	1.225	502.150
118	Station 1355.51, on center stop-gate, Adams basin (2′ east hollow quoin on pier), marked [] with chisel	8.592	509.545
119	Station 1377, on east wing, berme, Doty's bridge, No. 104, marked [] with chisel	13.754	514.720
120	Station 1413+66, on west end of Dive culvert, parapet, marked [] with chisel	6.859	507.847
121	Station 1461+55, on lower course, west wing, tow-path, Brockway's bridge, No. 105, marked [] with chisel	11.252	512.245
122	Station 1486+85, on east wing, tow-path, Cooley's basin bridge, No. 106, marked [] with chisel	12.913	513.945
123	Station 1520+22, on west end, Dive culvert, parapet, marked [] with chisel (tow-path)	5.366	506.418

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
124	Station 1581+44, on arch Dive culvert parapet, tow-path, marked [] with chisel	+0.872	502.009
125	Station 1654+76, on lower step, east end, tow-path abutment, Mechanic street bridge, No. 107, marked [] with chisel (Brockport)	9.771	511.113
126	Station 1691+76, on lower step, east wing, tow-path, Smith street bridge, No. 109, Brockport, marked [] with chisel	11.816	512.971
127	Station 1693+50, on east pier, east abutment, Brockport waste-weir, marked [] with chisel	+9.182	510.338
128	Station 1840+82, on dive culvert parapet, tow-path, marked [] with chisel	2.063	503.307
129	Station 1899+43, on offset, east wing, tow-path, Miner's bridge, No. 111, marked [] with chisel	9.849	511.128
130	Station 1922+98, on arch culvert parapet, tow-path, marked [] with chisel	0.753	502.167
131	Station 1990+05, on east stop-gate abutment, tow-path, (east of Holley), marked [] with chisel	8.973	510.307
132	Station 1994+42, on west end, west wing, tow-path, Orr's bridge, No. 113, marked [] with chisel	14.597	515.934
133	Station 2005+15, on east abutment, Holley waste-weir, marked [] with chisel	10.291	511.634
134	Station 2011+70, on west abutment, Holley waste-weir, old canal, marked [] with chisel	10.339	511.686
135	Station 2031+50, on east wing, tow-path, Main street bridge, No. 115, Holley, marked [] with chisel	13.759	515.118
136	Station 2054+20, on west wing, arch culvert parapet, tow-path, marked [] with chisel.	1.464	502.836
137	Station 2085+32, on east wing, tow-path, McCarthy's bridge, No. 116, marked [] with chisel	14.011	515.402
138	Station 2107+15, on arch culvert, parapet, tow-path, marked [] with chisel	— 3.408	498.016
139	Station 2152+05, on east wing, tow-path, Tuttle's bridge, No. 117, marked [] with chisel	+14.253	515.675

140	Station 2168+78, on east end of abutments, tow-path, stop-gate west of Holley, marked □ with chisel	+11.025	512.466
141	Station 2191+54, on east wing, tow-path, McGuire's bridge, No. 118, marked □ with chisel	14.262	515.729
142	Station 2250+84, on dive culvert parapet, tow-path, marked □ with chisel	4.398	505.889
143	Station 2279+20, on bottom step, west side, tow-path, Hulburton bridge, No. 119, marked □ with chisel	13.302	514.815
144	Station 2302+80, on arch culvert parapet, tow-path, marked □ with chisel	1.364	502.886
145	Station 2369+92, on west wall, Brockville waste-weir, marked □ with chisel	10.391	511.953
146	Station 2384+46, on east wing, tow-path, Brockville bridge, No. 120, marked □ with chisel	14.297	515.868
147	Station 2445+50 on east wing, tow-path, Hindsburgh bridge, No. 121, marked □ with chisel	14.503	516.110
148	Sitation 2554+93, on west wing, tow-path, dive culvert parapet, marked □ with chisel	0.950	502.623
149	Stations 2567+27, on east wings, tow-path, Jaquith's bridge, No. 123, marked □ with chisel	14.647	516.327
150	Station 2615+60, near east end parapet, tow-path, arch culvert, marked □ with chisel	1.386	503.095
151	Station 2623+63, on east end, east wing, tow-path, Bidwell's bridge, No. 124, marked □ with chisel	+13.456	515.170
152	Station 2688+50, on arch culvert parapet, near east end, tow-path, marked □ with chisel	1.142	502.895
153	Station 2742+44, on west wing, tow-path, Hall's bridge, No. 126, marked □ with chisel	14.333	516.198
154	Station 2764+70, on west wall, Albion waste-weir, marked □ with chisel	10.412	512.211
155	Station 2791+15, on lower step, east wing, tow-path, Ingersoll street bridge, No. 127, Albion, marked □ with chisel	11.142	512.957
156	Station 2804+40, on northwest corner of center pier, coping, swing-bridge, Albion, marked □ with chisel	7.930	509.753

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. B.
157	Station 2820+13, on west end, parapet, tow-path, Dive culvert, marked [] with chisel	4.808	506.640
158	Station 2892+20, on east wing, tow-path, Lattin's bridge, No. 129, marked [] with chisel	13.902	515.777
159	Station 2918+45, on west end of Dive culvert parapet, tow-path, marked [] with chisel	4.932	506.823
160	Station 2941+63, on lower step, west wing, tow-path, Gaines' basin bridge, No. 130, marked [] with chisel	12.115	514.020
161	Station 2980+44, on Dive culvert parapet, three feet from east end, tow-path, marked [] with chisel	5.508	507.412
162	Station 3041+70, on west abutment, tow-path, Eagle harbor waste-weir, marked [] with chisel	....	....
163	Station 3065+30, on lower step, east wing, tow-path, Eagle Harbor bridge, No. 131, marked [] with chisel	+13.016	514.995
164	Station 3102+50, on east wing, tow-path, Starkweather's farm bridge, No. 132, marked [] with chisel	14.143	516.145
165	Station 3125+60, on east wing, tow-path, Allen's bridge, No. 133, marked [] with chisel	14.073	516.088
166	Station 3164+70, on east wing, tow-path, Long's bridge, No. 134, marked [] with chisel	14.014	516.053
167	Station 3264+03, on center of Dive culvert parapet, tow-path, marked [] with chisel	7.759	509.857
168	Station 3310+06, on second lower step, west end, tow-path, Knowlesville bridge, No. 135, marked [] with chisel	13.742	515.868
169	Station 3388+85, on east end, Dive culvert parapet, marked [] with chisel	1.511	503.684
170	Station 3437+60, on east pilaster, road arch culvert parapet, tow-path, marked [] with chisel	2.101	504.303

171	Station 3446+97, on east end of abutment, tow-path, Knowlesville stop-gate, marked [] with chisel	10.614	512.822
172	Station 3499+25, on east wing, tow-path, Beal's bridge, No. 136, marked [] with chisel	12.135	514.375
173	Station 3562+93, on west wing, tow-path, Hasting's bridge, No. 137, marked [] with chisel	+13.330	515.607
174	Station 3613+50, on east wing, tow-path, Holloway's bridge, No. 138, marked [] with chisel	12.687	514.995
175	Station 3633+78, on north-west corner, west buttress, Medina aqueduct, marked [] with chisel	10.527	512.847
176	Station 3638+50, on east abutment, waste-weir, Medina, marked [] with chisel, berme	10.482	512.805
177	Station 3638+50, on west abutment, waste-weir, Medina, marked [] with chisel	10.405	512.728
178	Station 3644+28, on east wing, tow-path, Church street bridge, No. 139, Medina, marked [] with chisel	12.181	514.508
179	Station 3680, on lower step, east end, berme, Prospect street bridge, Medina, No. 140½, marked [] with chisel	14.172	516.520
180	Station 3701+93, on east end, old stop-gate abutment, marked [] with chisel	11.071	513.432
181	Station 3739+87, on Dive culvert parapet, tow-path, marked [] with chisel	8.291	510.675
182	Station 3801+18, on west wing, tow-path, Jackson's bridge, No. 141, marked [] with chisel	12.921	515.342
183	Station 3854+63, on east wing, tow-path, Shelby basin bridge, No. 142, marked [] with chisel	14.512	516.965
184	Station 3914+07, on east wing, tow-path, Gorman's bridge, No. 143, marked [] with chisel	+14.394	516.882
185	Station 3934+32, on west wing, tow-path, Coon's bridge, No. , marked [] with chisel	....	....
186	Station 4016+72, on center of dive culvert parapet, tow-path, marked [] with chisel.	8.172	510.722
187	Station 4051+12, on lower step, west wing, tow-path, Main street bridge, No. 145, Middleport, marked [] with chisel	12.295	514.872
188	Station 4075+65, on Middleport waste-weir, east abutment, marked [] with chisel.	10.880	513.465

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
189	Station 4114+50, on west end, tow-path, Dive culvert parapet, marked □ with chisel	5.275	507.884
190	Station 4182, on west wing, tow-path, Watson's bridge, No. 147, marked □ with chisel	13.042	515.691
191	Station 4200+70, on west abutment, near front angle, waste-weir, marked □ with chisel	10.816	513.476
192	Station 4307+37, east wing, tow-path, Hurd's bridge, No. 148, marked □ with chisel	13.205	515.929
193	Station 4354+32, on lower step, east wing, tow-path, Reynales basin bridge, marked □ with chisel	12.737	515.490
194	Station 4422+04, on west abutment, berme, Mabee's waste-weir, marked □ with chisel	10.099	512.892
195	Station 4493+80, on center of dive culvert parapet, tow-path, marked □ with chisel	5.622	508.458
196	Station 4610+55, on center of dive culvert parapet, tow-path, marked □ with chisel	+4.850	507.756
197	Station 4722+97, on east wing, tow-path, Millard's bridge, No. 153, marked □ with chisel	16.966	519.940
198	Station 4810+60, on center of dive culvert parapet, tow-path, marked □ with chisel	3.136	506.162
199	Station 4840+92, on west end of dive culvert parapet, tow-path, marked □ with chisel	3.199	506.244
200	Station 4923+91, on lower step, west wing, tow-path, Comstock's bridge, No. 156, marked □ with chisel	15.438	518.532
201	Station 4944+50, on lower step, east wing, tow-path, Adams street bridge, No. 157, marked □ with chisel	11.564	514.671

202	Station 4960+20, on lower step, east wing, tow-path, Mill street bridge, No. 159, marked [] with chisel	14.032	517.148
203	Station 4966+04, on east abutment, berme, Lockport waste-weir, marked [] with chisel	13.473	516.625
204	Station 4999+18, on east berme, hollow quoin (south side), Lock 67, Lockport, marked [] with chisel	20.737	523.877
205	Station 5005+86, on east berme, hollow quoin, Lock 71, Lockport, marked [] with chisel	10.564	569.631
206	Station 60+80, on eye-bolt in rock ledge, tow-path	17.578	576.718
207	Station 218+74, on south-east corner, drop-culvert wall, Murphy's farm (second cor. from top), marked [] with chisel	+17.222	576.551
208	Station 320+28, on first course stone, west end of pier, Hawley's bridge, No. 167, marked [] with chisel	14.626	573.961
209	Station 414+32, on east hollow quoin (south), Sulphur Spring guard-lock pier, marked [] with chisel	20.460	580.446
210	Station 63+87, on west front angle foundation, old bridge abutment, marked [] with chisel	14.006	574.003
211	Station 121+87, on lower step, east wing, berme, Pendleton change bridge, No. 169, marked [] with chisel	14.605	574.612
212	Station 353+80, on lower step, east end, east wing, tow-path, New Home bridge, No. 173, marked [] with chisel	15.208	575.258
213	Station 1027+42, on east end, south side, tow-path, Erie railroad bridge abutment, marked [] with chisel	9.888	570.059
214	Station 1057+20, on north-east corner of masonry, end of Tonawanda dam, marked [] with chisel	14.131	574.308
215	Station 1090+15, on west wing, tow-path, Bouck street bridge, No. 180, Tonawanda, marked [] with chisel	17.987	578.194
216	Station 1274+90, on east wing, tow-path, three-mile grocery bridge, No. 183, marked [] with chisel	17.225	577.617
217	Station 1357+45, on third course, west wing, tow-path, Cherry's bridge, No. 184, marked [] with chisel	+16.030	576.504

WESTERN DIVISION — ERIE CANAL — *List of benches, etc.* — (Continued).

Number.	DESCRIPTION.	Elevation above C. B.	Elevation above T. W.
218	Station 1509+32, on second course, west wing, tow-path, Grand Island ferry bridge (Scott's), No. 186, marked [] with chisel	15.416	576.042
219	On west end, berme abutment, Hertel avenue bridge, Black Rock, No. 189, not marked	16.533	577.320
220	Station 1690+74, on west hollow quoin, north side, guard-lock, Black Rock, marked [] with chisel	15.062	575.868
221	Station 1690+74, on west hollow quoin, east end, south side, guard-lock, Black Rock, marked [] with chisel	14.871	575.677
222	Iron bolt in second coping stone, south-west wing, south abutment, Hamilton street bridge, No. 190, Black Rock	16.140	579.371
223	West wing, tow-path abutment, fourth stone from bottom, Amherst street bridge, No. 191, Black Rock, marked [] with chisel	15.412	578.643
224	East wing, tow-path abutment, bottom step, Mill street bridge, No. 192, marked [] with chisel	16.000	579.231
225	East end, fourth window-sill from east end of Manning's malt house, not marked	15.464	578.695
226	Step, east end, berme abutment, Ferry street bridge, No. 194, marked [] with chisel	15.196	578.427
227	North end, door-sill of engine-room to water-works, west end of building, not marked	15.495	578.726
228	East end, tow-path abutment, N. Y. C. railroad bridge, marked [] with chisel	+26.538	589.769
229	North-west corner, west wing, north abutment, York street bridge, No. 196, first stone below coping, marked [] with chisel	25.423	588.654
230	North-west wing, tow-path abutment, Georgia street bridge, No. 197, marked [] with chisel	19.608	582.839
231	Lowest step, west end, north abutment, N. Y. C. railroad bridge, marked [] with chisel	16.287	579.518

232	West end, north abutment, fourth step from bottom, Genesee street bridge, No. 200, marked [] with chisel	17.842	581.073
233	Third door-sill, Revere house, west of Erie street, west end, not marked	13.090	576.321
234	Commercial street bridge, No. 204, east end, south abutment, lowest step, marked [] with chisel	14.273	577.505
235	Main street bridge, No. 208, east end of coping outside of railing, north abutment, west end, Hamburgh canal; marked [] with chisel	25.204	588.435
236	Main street bridge, No. 208, west wing, north abutment, lowest step, Hamburgh canal, marked [] with chisel	14.459	577.690
237	Perry street bridge, No. 211, east abutment, north wing, Clark and Skinner canal, marked [] with chisel	18.003	581.234
238	Elk street bridge, No. 212, east abutment, north end, Clark and Skinner canal, marked [] with chisel	+21.476	584.707
239	Ohio street bridge, No. 213, east abutment, north end, Clark and Skinner canal, marked [] with chisel	21.177	584.408
240	Scott street bridge, No. 210, east abutment, north end, second coping stone, Clark and Skinner canal, marked [] with chisel	22.510	585.741
241	Michigan street bridge, No. 214, north-east end, north abutment, third coping stone outside of rail, Hamburgh canal, marked [] with chisel	24.315	587.546
242	Chicago street bridge, No. 215, west end, south abutment, by rail post, Hamburgh canal, marked [] with chisel	23.025	586.256
243	Louisiana street bridge, No. 216, west end, south abutment, Hamburgh canal, marked [] with chisel	23.439	586.670
244	Louisiana street bridge, No. 216, north abutment, east wing, Hamburgh canal, not marked	23.126	586.357
245	Perry street bridge, No. 217, east abutment, north end, Ohio slip, marked [] with chisel	24.419	587.650

NOTE.— The work between Ferry street and slip No. 3, was intended to be taken out so as to give 10½ feet of water, but by final estimate in 1876 on this work, the engineer in charge gives it that 6,635 cubic yards were left in +0.5, and 1,910 cubic yards were left in +1.00. See appendix to State Engineer's report for 1876, page 78, hence nine feet has been adopted here as the depth of water above guard-lock.

SECTIONS, WHETHER OF EARTH OR ROCK IN BOTTOM OF CANAL, ROCHESTER TO LOCKPORT.

Construction section.	LENGTH.	Stations.	Description.		Location.
267	28 chains	0 to 28	Rock		Town line between Gates and Greece.
	42 chains	28 to 70		Earth	
268	46 chains	0 to 46		Earth	
	34 chains	46 to 80	Rock		
269	78 chains	0 to 78	Rock		
270	86 chains	0 to 86	Rock		
271	25 chains	0 to 25	Rock		
	10 chains	25 to 35		Earth	
	23 chains	35 to 58	Rock		
	17 chains	58 to 75		Earth	
272	12 chains	0 to 12		Earth	Henpeck.
	14 chains	12 to 26	Rock		
	35 chains	26 to 61		Earth	
	19 chains	61 to 80	Rock		
273	39 chains	0 to 39	Rock		Town line between Greece and Ogden.
	5 chains	39 to 44		Earth	
	4 chains	44 to 48	Rock		
	32 chains	48 to 80		Earth	
274	33 chains	0 to 33		Earth	
	7 chains	33 to 40	Rock		
	20 chains	40 to 60		Earth	
275	36 chains	0 to 36		Earth	Spencerport.
	5 chains	36 to 41	Rock		
	79 chains	41 to 120		Earth	
276	83 49-100 chains	0 to 83+ 49		Earth	
277	63 24-100 chains	0 to 63+ 24		Earth	
278	75 97-100 chains	0 to 75+ 97		Earth	Adams basin.
279	43 chains	0 to 43		Earth	Adams basin.
	20 chains	43 to 63	Rock		
	13 49-100 chains	63 to 76+ 49		Earth	
280	32 chains	0 to 32		Earth	
	9 chains	32 to 41	Rock		
	5 chains	41 to 46		Earth	
	20 chains	46 to 66	Rock		
	4 chains	66 to 70		Earth	
281	1 chain	0 to 1		Earth	Cooley's basin.
	36 chains	1 to 37	Rock		
	2 chains	37 to 39		Earth	
	22 chains	39 to 61	Rock		
	23 chains	61 to 84		Earth	
	6 chains	84 to 90	Rock		
283	9 chains	0 to 9	Rock		
	26 chains	9 to 35		Earth	
	8 chains	35 to 43	Rock		
	6 chains	43 to 49		Earth	
	13 chains	49 to 62	Rock		
283	23 chains	0 to 23	Rock		
	17 chains	23 to 40		Earth	
284	67 chains	0 to 67		Earth	Brockport.
285	23 chains	0 to 23		Earth	
	24 chains	23 to 57	Rock		
	23 chains	57 to 80		Earth	

SECTIONS, WHETHER OF EARTH OR ROCK IN BOTTOM OF CANAL, ROCHESTER TO LOCKPORT—(*Continued*).

Construction section.	Length.	Station.	Description.		Location.
286	11 chains	0 to 11		Earth	
	10 31-100 chains	11 to 41+ 31	Rock		
	33 69-100 chains	41+31 to 75		Earth	
	15 chains	75 to 90	Rock		
287	16 chains	0 to 16		Earth	County line between Monroe and Orleans.
	26 chains	16 to 42	Rock		
	11 chains	42 to 53		Earth	
	9 chains	53 to 62	Rock		
	2 chains	62 to 64		Earth	
*288					No record in office.
289	6 chains	0 to 6		Earth	
	2 chains	6 to 8	Rock		
	11 chains	8 to 19		Earth	
	3 chains	19 to 22	Rock		
	18 chains	22 to 40		Earth	
	17 chains	40 to 57	Rock		
	43 chains	57 to 100		Earth	
290	42 chains	0 to 42		Earth	
	6 chains	42 to 48	Rock		
	35 chains	48 to 83		Earth	
291	51 chains	0 to 51		Earth	
	28 chains	51 to 79	Rock		
	1 chain	79 to 80		Earth	
292	80 chains	0 to 80	Rock		Hulburton.
293	33 chains	0 to 33	Rock		
	51 chains	33 to 84		Earth	
294	17 chains	0 to 17	Rock		Brockville.
	5 chains	17 to 22		Earth	
	21 chains	22 to 43	Rock		
	28 chains	43 to 71		Earth	
	5 chains	71 to 76	Rock		
	4 chains	76 to 80		Earth	
295	4 chains	0 to 4		Earth	Hindsburg.
	7 chains	4 to 11	Rock		
	21 chains	11 to 42		Earth	
	13 chains	42 to 55	Rock		
	26 chains	55 to 80		Earth	
296	24 chains	0 to 24		Earth	
	7 chains	24 to 31	Rock		
	9 chains	31 to 40		Earth	
	36 chains	40 to 76	Rock		
	4 chains	76 to 80		Earth	
297	5 chains	0 to 5		Earth	
	12 chains	5 to 17	Rock		
	53 22-100 chains	17 to 70+ 12		Earth	
298	70 22-100 chains	0 to 70+ 22		Earth	
310	10 chains	0 to 10		Earth	Albion.
	2 chains	10 to 12	Rock		
	60 44-100 chains	12 to 72+ 44		Earth	
311	90 chains	0 to 90		Earth	
312	80 chains	0 to 80		Earth	Gaines Basin.

* No record in office.

SECTIONS, WHETHER OF EARTH OR ROCK IN BOTTOM OF CANAL, ROCHESTER TO LOCKPORT — (*Continued*).

Construction section.	Length.	Station.	Description.		Location.
313	87 chains	0 to 87		Earth	Eagle Harbor.
314	87 chains	0 to 87		Earth	
315	88 chains	0 to 88		Earth	
316	76 chains	0 to 76		Earth	Knowlsville.
317	76 chains	0 to 76		Earth	
318	90 chains	0 to 90		Earth	
319	70 chains	0 to 70		Earth	
	10 chains	70 to 80	Rock		
320	44 58-100 chains	0 to 44+ 58	Rock		
321	1 10-100 chains	0 to 1+ 10		Earth	Medina.
	9 90-100 chains	1+ 10 to 11	Rock		
	4 chains	11 to 15		Earth	
	3 chains	15 to 18	Rock		
	1 chain	18 to 19		Earth	
	36 chains	19 to 55	Rock		
	25 chains	55 to 80		Earth	
322	12 chains	0 to 12	Rock		
	56 chains	12 to 68		Earth	
	4 chains	68 to 72	Rock		
	30 chains	72 to 102		Earth	
	12 chains	102 to 114	Rock		
323	47 chains	0 to 47		Earth	Shelby basin.
	14 chains	47 to 61	Rock		
	8 chains	61 to 69		Earth	
	7 chains	69 to 76	Rock		
	11 8-100 chains	76 to 87+ 08		Earth	
324	14 chains	0 to 14		Earth	
	1 chain	14 to 15	Rock		
	8 chains	15 to 23		Earth	
	24 chains	23 to 47	Rock		
	19 chains	47 to 66		Earth	
	2 chains	66 to 68	Rock		
	6 chains	68 to 74		Earth	
325	14 chains	0 to 14	Rock		
	6 chains	14 to 20		Earth	
	3 chains	20 to 23	Rock		
	29 chains	23 to 52		Earth	
	15 chains	52 to 67	Rock		
	3 chains	67 to 70		Earth	
	4 chains	70 to 74	Rock		
326	10 chains	0 to 10		Earth	Middleport.
	2 chains	10 to 12	Rock		
	68 chains	12 to 80		Earth	
327	18 chains	0 to 18		Earth	Johnson creek.
	20 chains	18 to 38	Rock		
	8 chains	38 to 46		Earth	
	3 chains	46 to 49	Rock		
	2 chains	49 to 51		Earth	
	14 chains	51 to 65	Rock		
	4 chains	65 to 69		Earth	
	13 33-100 chains	69 to 82+ 33	Rock		
328	10 chains	0 to 10	Rock		
	6 chains	10 to 16		Earth	
	54 chains	16 to 70	Rock		
	14 30-100 chains	70 to 84+ 30		Earth	

SECTIONS, WHETHER OF EARTH OR ROCK IN BOTTOM OF CANAL, ROCHESTER TO LOCKPORT — (*Continued*).

Construction section.	Length.	Stations.	Description.		Location.
329	56 chains	0 to 56		Earth	Reynales' basin.
	3 chains	56 to 59	Rock		
	10 chains	59 to 69		Earth	
	2 chains	69 to 71	Rock		
	10 48-100 chains	71 to 81+ 48		Earth	
330	11 chains	0 to 11		Earth	Mabees.
	20 chains	11 to 31	Rock		
	12 chains	31 to 43		Earth	
	37 chains	43 to 80	Rock		
331	36 chains	0 to 36		Earth	Gasport.
	24 chains	36 to 60	Rock		
	7 chains	60 to 67		Earth	
	13 chains	67 to 80	Rock		
332	13 chains	0 to 13	Rock		Orangeport.
	14 chains	13 to 27		Earth	
	17 chains	27 to 44	Rock		
	36 chains	44 to 80		Earth	
333	19 chains	0 to 19		Earth	Lockport.
	17 chains	19 to 36	Rock		
	44 chains	36 to 80	Earth		
334	92 chains	0 to 92		Earth	Lockport.
335	62 chains	0 to 62		Earth	Lockport.
	6 chains	62 to 68	Rock		
336	66 chains	0 to 66		Earth	Lockport.
337	45 chains	0 to 45		Earth	Lockport.

REPORT

OF THE

Assistant Engineer in Charge

OF EXAMINATIONS OF THE

SOURCES OF WATER SUPPLY

TO THE

BLACK RIVER AND ITS TRIBUTARIES.

REPORT.

OFFICE OF THE STATE ENGINEER AND SURVEYOR,
ALBANY, N. Y., *December*, 1888.

HON. JOHN BOGART,
State Engineer and Surveyor, Albany, N. Y.:

DEAR SIR.— I beg herewith to submit to your consideration the following report on Black river reconnaissance, undertaken in compliance with the following resolution of the Senate:

ALBANY, N. Y., *March* 8, 1888.

" WHEREAS, It is alleged that the State of New York is diverting from their natural courses the waters of the Black river for canal purposes, and that the waters so diverted are essential for manufacturing purposes on said river; and,

WHEREAS, Manufacturing business along said river suffers from such diversion, by reason of the natural decrease of the tributaries from whose banks and water-shed the forests have been cut, and owners of water power engaged in such manufacturing business have never been protected against such diversion by artificial means for storing water during the spring months; and,

WHEREAS, The water of adjacent streams could be used for providing for a partial equivalent for water so diverted; therefore,

Resolved, That the State Engineer and Surveyor be directed to investigate the allegations above recited, by making an examination of the question; gathering the necessary data by going upon the ground, if that shall be necessary; referring to the records of the Canal Board, and, in such other ways as he shall deem advisable, inform himself, in order to report to the Senate whether an equitable obligation exists upon the part of the State, to make provision for the protection of riparian owners against further diversion of water by erecting a reservoir at some point in either Hamilton, Herkimer or Lewis counties, which shall accomplish that purpose."

In pursuance of your instructions, after an exhaustive investigation on the ground and among the archives of this and kindred departments, I have to submit the following as the result:

The construction of the Black River canal was authorized by Act, Chapter 157, Laws of 1836, which contained, among other provisions, one to the effect, that " the feeder and canal shall be so constructed as to pass as large a quantity of water to the Erie canal as can, reasonably, be spared from the Black river and from the northern portion of the Black River canal." Section 4 continues: "The Commissioners of the Canal Fund shall pay, from any moneys in the treasury belonging to the Canal Fund, towards the construction of said canal and feeder, such sum as the Canal Board shall estimate and certify would be the probable expense of a feeder from the Black river to the Erie canal, sufficient to supply the additional water that will be required on the Rome level under the act for enlarging the Erie canal, passed May 11, 1835." See Chapter 157, page 207, Laws 1836.

Not, however, till 1848, was the dam built which was to divert the waters from the Black river at Forestport (formerly Williamsville) and the feeder tested by the admission of a little water. No use was made of the feeder, however, till 1849, when in early summer it was filled and a boat excursion made upon it on July fourth of that year.

The canal proper extends from the Erie canal at Rome to the Black river at Lyons Falls (formerly High Falls). From Lyons Falls to Carthage, forty-two and one-half miles, navigation is maintained on the river by means of jetties, locks and dams.

The feeder is ten miles in length and extends from Forestport to the summit level at Boonville, which place is ten miles from Lyons Falls on the north and twenty-five miles from Rome on the south.

The canal was completed and brought into use, with the feeder, from Boonville to Rome in 1850, and from Boonville to Lyons Falls in 1856. The feeder has been utilized every year since and including 1849, being designed to convey 16,000 cubic feet per minute, with the full head afforded by the Forestport dam.

On pages 289–290 of the State Engineer and Surveyor's report for 1862, D. C. Jenne, Division Engineer, says: "All the measurements taken in the early progress of this work made the volume of water in the Black river, at the point where it is diverted, from 14,000 to 16,000 cubic feet per minute at minimum flow."

The amount of water in the river at its lowest stage, during the summer of 1849, was only 9,000 cubic feet per minute, a deficiency of about 5,000 to 7,000 cubic feet per minute from former estimates. But it should be remarked that the water was lower than ever before known by those familiar with the river for thirty or forty years.

Nearly the whole volume of water was diverted for three months in 1849 to feed the Erie canal, which left the river nearly dry from the head of the feeder to Lyons Falls, and reduced it thirty or forty per cent. below the falls.

At this point arises the question of the disposition of the water passing through the feeder; and I have concluded, from past records and careful measurements taken by myself in September, 1888, that, with the feeder running at 16,000 cubic feet per minute, there is returned to the Black river by lockages, waste-weirs, sluice-ways and feed through lock-gates, an average amount of 5,000 cubic feet per minute, as nearly as may be determined. There has therefore been diverted, under these conditions, an amount of 11,000 cubic feet per minute.

When the water was first diverted in 1849, it created grave apprehensions in the minds of mill owners along the river. From Forestport to Lyons Falls the channel was left nearly dry, virtually stopping every mill, and, below that point, crippling some and stopping others.

Recourse was had at once to the Canal Commissioners, who, for three or four years immediately succeeding 1849, "maintained that the appropriation was only a temporary one; and some claims based upon that view were made out and allowed to various parties above Lyons Falls, but to none, we believe, below that point. In 1854, however, on the refusal of Mr. Schoonmaker, the then auditor, to pay one of the drafts given by the Canal Commissioners on such claim, on the ground that the appropriation was a permanent one and the Canal Commissioners had no authority to settle a claim of that character, the case was carried to the Supreme Court and from that court to the Court of Appeals, to test the question. The latter tribunal sustained the auditor and held that the appropriation was a permanent one.

After this decision the parties interested in the water powers along the river filed claims for permanent damages, and a large number were filed by persons who had no interest in 1849, for alleged injuries sustained during a subsequent occupancy or ownership. A question having arisen whether the claims were not barred by statute, from not having been filed within a year after the injury accrued, the Legislature very properly came to their relief in the passage of a special act, Chapter 245, Vol. 1, Laws of 1857."

These claims, some sixty-two in number, aggregating over six hundred thousand dollars, and extending from Forestport to the mouth of the Black river, were presented to the canal appraisers.

The hearing commenced on July 8, 1858, and was not completed until December of that year.

In view of the great number and similarity of these claims, two were settled upon as together representing the whole, and "stipulations were entered into by consent of all parties that all the testimony taken in the several claims might be used as such in them all."

The leading case to which reference was made in deciding others at and below Watertown was the claim of the "Black River Woolen Company," of Watertown, while that of "Platt Williams," of Williamsville (Forestport), corresponded with all others above Watertown.

I would refer to the testimony taken in these claims as contained in Vol. 41 of "Appraisals," for a more minute recitation of the merits of individual cases. I have drawn freely, in this report, from the awards by the appraisers in the claims above referred to and all quotations otherwise unacknowledged are made from these awards.

After reviewing the construction and utilization of the canal and feeder, the diversion of water and its effects, the Appraisers refer to the step taken by the Legislature for the relief of the mill owners.

It seems that D. C. Jenne, Resident Engineer on the Eastern Division of the canals, under instructions of the Canal Board, made a report on the subject of the feeder, the diversion of the water, and the probabilities of its restoration by means of reservoirs, in March, 1850, (Vol. III., Senate Documents 1850, No. 102), in which he said, "Unless an amount of water be returned to the Black river equal to the quantity thus diverted, * * * heavy damages to water power will ensue, the amount of which will be almost incalculable."

"Based upon this report the Legislature passed an act (Chapter 181, Laws 1851) providing for the construction of reservoirs. It required the Canal Commissioners to create, if practicable, reservoirs of sufficient capacity to supply the Black River canal feeder with such quantity of water during the summer months as shall be necessary for the supply of the Black River and Erie canals and as shall give to the Black river, as near as may be, as much water as ordinarily flows therein during the summer months." In the third section of the act, the object is more fully stated as being "that the waters from said reservoirs shall be discharged so that the waters thus reserved shall be let into said Black river during the summer months, in such manner and in such quantity as to give as far as practicable to the inhabitants residing on said river, the benefit of said reserved waters when the same shall be required for use, and such supply shall not be less than the quantity which ordinarily flows in said river during the summer, provided the supply from said reservoirs will furnish such quantity after supplying the Black River canal and the Erie canal with water."

It seems that at this time (1858-9), only the North Branch reservoir had been completed, work having been stopped on South Branch, Woodhull and Chub lakes, in 1857, for lack of funds. Water having been abundant in 1857 and nearly so in 1858, it was impossible, up to the time of the award, to judge of the effect of the one completed.

The appraisers continue, under the head of "Difficulties in the way of estimating damages":

"Under the circumstances already stated, as to the unfinished condition of the reservoirs, eight years after the Legislature directed their construction, and the actual stoppage of all work upon them, with only the smallest of the four finished and no certainty when, if ever, the others will be completed, and without knowledge as to their success, if completed, in restoring the water to the claimants, we must necessarily grope in the dark to some extent in determining the damages. If the reservoirs were completed, and they accomplished wholly or in an ascertained part the desired object, it would have an important bearing in reducing the amount of permanent injury to this water power.

In view of these things, these claims can not receive as satisfactory decision as we should desire, until the successful or unsuccessful working of the reservoirs, if completed, can be known, or the policy be determined, whether or not they are to be completed; and the Appraisers have almost as little faith in the correctness of the conclusions which they may reach as in the expectation that those conclusions will satisfy either the claimants or the State. For the nearly four years that the present board of appraisers have held office, they have kept these claimants at bay, in the hope that a time would come when they could dispose of the claims in a manner that at least would be satisfactory to themselves. But the claimants have waited patiently nine years, trusting to the good faith of the State to make good their losses; and it is unreasonable to ask them to wait for an indefinite number of years more. The State has permanently appropriated this water and will use it, and has, by the act of appropriation in the exercise of its sovereignty, the right to use and control it through all future time; and enough is known from the experience of the last nine years to show that considerable damage has already accrued, which no mere restoration of the water can atone for. If the reservoirs were completed, it is questionable whether they would wholly restore the original state of things. As the country clears up, the waters will become less by evaporation and by other natural causes that tend to diminish the flow in the stream and its tributaries that supply the reservoirs, and the quantity now obtained from other sources to feed the Erie canal will be less, and it is not impossible that the State may yet require not only all the natural flow at the feeder, but also all the reserved waters in the reservoirs to keep up navigation in the Black River and Erie canals."

Further on, under the head of "Certain leading principles that will be recognized and followed in deciding these cases," they resume:

"With a view to save the necessity of presenting our general views in each case, and also with a view of placing ourselves plainly on the record, so that errors, if they are made, may be corrected on appeal; we propose to state here certain leading principles that will be recognized and followed in passing upon this and other claims in its vicinity. Having done this, we shall attempt to avoid the reiteration of them in the other awards that are to follow.

First. The State will be held liable for the damage sustained by the riparian owners in consequence of the diversion, on the principle that fresh-water rivers, to the middle of the stream, belong to the owners of the adjacent banks; that they are entitled to the usufruct of the waters as appurtenant to the fee, and for an interruption in the enjoyment of their privileges, in that respect, in consequence of public improvements, made by the State, are entitled to compensation for damages sustained. (Commissioners of Canal Fund *v.* Kempshall, 26 Wend., 404.)

Second. There can be allowance made, only, to those who owned in 1849, or to the assignees of their claims.

Third. Nor can any allowance be made, even to the owners of 1849, for any special damages from year to year, since, except by way of interest on the sum that shall be determined as the real loss, when the injury accrued.

Fourth. The State can not be held to pay for mills or other structures erected, or investments made since that year, when everybody knew that the waters had been diverted. These erections or investments were at the risk of those who made them.

Fifth. Nor can we take into consideration remote and contingent damages to property separate and distinct from water power, and the property upon it, alleged to have been depreciated in value by the diversion.

Sixth. In estimating damages to a particular water power, additional expenses incurred in putting in new wheels, machinery, etc., adapted to the new state of things, will be considered; but only as bearing upon the extent of the damages of 1849, which required such expenditures to restore the power.

Seventh. While we can not wholly ignore the fact that the State has had in contemplation the erection of the reservoirs, and may yet complete them and the water be restored, we can only take these things into account in a qualified and limited sense.

Eighth. An appraisal will be fixed on the injury to the property at its value in 1849 and nine years interest allowed thereon."

With these principles in view, the Board of Appraisers handed down their decisions on each individual claim.

The Canal Commissioners, however, appealed from these awards in a number of cases, to the Canal Board, and the following is a transcript of the decision of said board on said appeal, adopted February 10, 1860 :

" WHEREAS, By reason of the appropriation of the waters of the Black river in 1849, for the purpose of furnishing a supply of water to the Black River and Erie canals, and under the Act, Chapter 157 of the Laws of 1836, it was the intention and object so to construct the canal and feeder as to pass no larger quantity of water to the Erie canal than could reasonably be spared from the Black river, and damages having accrued and been awarded to certain claimants owning premises along the said river below Lyons Falls, and the Canal Commissioners having appealed from the awards of the Canal Appraisers in the following cases, to this board; and,

WHEREAS, In the opinion of this board, the said appraisers, in making their award of damages, did not take into consideration the full amount and flow of water to be obtained and supplied to the said river and feeders by the construction and maintenance of the reservoirs designed to limit the use of the water of said river by the State as contemplated by the act of 1836, and which reservoirs were in process of construction, and will soon be completed so as to supply a quantity of water nearly adequate to the wants of the State, as now contemplated, and thus return to the claimants the water of which they would otherwise have been deprived; therefore,

Resolved, That the awards of the Canal Appraisers in the twenty-two cases stated below as fixed in the first column of figures set opposite to the names of the respective claimants, be reduced to the sums fixed and stated in the second column of figures in said schedule, the rate of reduction being thirty-five per cent. "on the amount of each award of the appraisers."

These twenty-two claims awarded by appraisers, aggregated $91,108 and as reduced by the Canal Board, $59,220.20.

The above decision of the Canal Board constitutes the basis of the claims and representations now put forward by parties interested in the maintenance of the original flow of the Black river.

It seems, therefore, that the Canal Board reduced the awards above cited, thirty-five per cent., on the ground that the Appraisers did not "take into consideration the full amount and flow of water to be obtained and supplied to said river and feeders by the construction and maintenance of the reservoir," referring to Woodhull, North and South Branch and Chub lakes, of which the second alone had been completed.

In 1859, however, reservoirs to the capacity of 11,000 cubic feet per minute, for 115 days, were ordered completed, and the following were brought into use:

	Cubic feet.
Woodhull	780,943,680
North Branch (twice)	619,868,800
South Branch	421,190,000
Making a total of	1,822,002,480

which was estimated sufficient to accomplish the end.

Unfortunately, from some cause or other, which I shall later endeavor to point out, they did not entirely avail, and to meet the demands for more water on the Erie, surveys were frequently made for additional storage capacity, recommendations urged and bills passed for an increase in the supply until, at the present time, there are in existence the reservoirs enumerated below.

In the endeavor to ascertain as nearly as possible just what can be expected of them at the present time I met with obstacles which, though not unforeseen, were nevertheless annoying and well-nigh insurmountable. As far back as 1862 most urgent recommendations were made by the engineers in charge of that division of the canals in which the reservoirs were included, to the effect that careful records should be made at each reservoir of

First, The annual rainfall;

Second, The depth of water available at any time, and

Third, The condition of the gates or valves, daily, while in use.

Notwithstanding the palpable necessity for such data in connection with the economic and methodical management and use of storage reservoirs, no such provision has at any time been made by the Legislature; so that to-day, after thirty years continuous use of these costly adjuncts to our public works, the only information to be gathered from the records of the department is the original, time-honored and oft repeated estimate of total capacity of each reservoir, coupled possibly with the statement from year to year that navigation was or was not delayed by lack of water. The mill owners claim that the reservoirs have not availed to accomplish the end desired. If that be so they are either inadequate or are not utilized to the extent of their capacity.

In accordance with your instructions I made a personal examination of the existing system, visiting all the below-mentioned reservoirs save the two least important, and have enumerated in the last column the amounts of water which to the best of my belief, from information thus acquired, can be relied upon each season for distribution in time of drouth.

In the first four columns, I quote from the report of the State Engineer for the year ending September 30, 1887, Assembly Document No. 25, p. 61:

NAME.	Mean area, acres.	Mean depth, feet.	Total capacity, cubic feet.	Available capacity, cubic feet.
White lake	296	5	64,468,800	64,000,000
Chub lake	200	4	34,848,000	....
Sand lake	306	15	199,940,400	200,000,000
Woodhull lake	1118	18	876,601,400	438,000,000
First, Second, Third, Bisbys	......	3½	40,000,000	40,000,000
Canachagala lake	320	4	55,756,800	56,000,000
North lake	277	28	337,851,360	676,000,000
South lake	372	26	421,312,320	350,000,000
Twin lakes	175	8	60,984,000	60,000,000
				1,884,000,000
Sixth, Fulton Chain	109	10½	....	300,000,000
Seventh, Fulton Chain	867			
To which should be added First, Second, Third, and Fourth, Fulton Chain				500,000,000
Beaver river	1675	9	....	328,000,000
				3,012,000,000

Making a total of, say, 3,000,000,000 cubic feet; or, enough to afford
16,000 cubic feet per minute, for 130 days; or,
11,000 cubic feet per minute for 189 days; or,
23,000 cubic feet per minute for 90 days; or,
34,000 cubic feet per minute for 60 days.

Plainly, then, the alleged difficulty can not arise from lack of capacity, for, by a liberal estimate, the present system holds, every Spring, sufficient water to supply the total flow in the feeder for four months, without disturbing the natural flow of the river, and thus increase that flow, below Lyons Falls, by 5,000 cubic feet per minute, or, enough to maintain navigation for six months, diverting only 5,000 cubic feet per minute from the river between Forestport and Lyons Falls, for which diversion award was made by the appraisers in 1859, and damages paid, or, sufficient to afford 23,000 cubic feet per minute for three months, the extent of the longest dry season known in the past seventy years, or, finally, enough to supply 34,000 cubic feet per minute for sixty days, now estimated by interested parties, as the period during which the present diversion is felt by the water-users. But, this water is *not* supplied, at the time when most needed; for, to my personal knowledge, water did not flow over the present Forestport dam for several days last summer, and evidence is not lacking to show that such is the case for greater or less periods, each season.

It is no less a fact, however, that the reservoirs are exhausted at the close of every season, save, perhaps, Woodhull, which, it will be observed, is estimated at less than half its total capacity. Lack of sufficient water-shed precludes the possibility of filling this lake in less than two years and its waters are therefore husbanded each year, to provide for possible contingencies the following season.

For an explanation of this anomalous condition of affairs, it is necessary to abandon calculations and theories and observe more closely the practical and absolute circumstances governing the case.

These lakes are situated in a region, the inaccessibility of which is credible only to those who have endeavored to penetrate it; but a glance at the accompanying map will serve to afford an idea of the large area over which they are scattered. The present systems are distributed among three counties, and may be classified into as many sections, according to the channels through which their waters are brought into use:

First. Reservoirs impounding the head-waters of the Black river.

Second. Reservoirs impounding the head-waters of the Moose river.

Third. Reservoirs impounding the head-waters of the Beaver river.

The BLACK RIVER SYSTEM comprises Woodhull; Sand, First, Second and Third Bisbys, White, Little Woodhull and Gull lakes, discharging through Big Woodhull creek into the eastern end of the present Forestport pond at head of the feeder. Also, North, South, Canachagala and Twin lakes, discharging through the river proper into the southern end of the same pond.

The MOOSE RIVER SYSTEM is that formed by two reservoirs on the Fulton chain lakes, one including First, Second, Third and Fourth lakes, and the other Sixth and Seventh lakes; discharging through that river into the Black river, a few rods above Lyons Falls.

The BEAVER RIVER SYSTEM contains but one reservoir, that at Stillwater; whose waters are conveyed by that stream to the Black river at Castorland, thirty-two and one-half miles below Lyons Falls.

Scattered though they are, and inaccessible, the reservoirs of the Black river system are intrusted to the management of two men; one having quarters at Woodhull dam and the other at North lake. It is utterly and physically impossible for these two men to regulate the flow of water and as well guard it when it is not needed. Much of the country is still in process of being lumbered, and, in many cases, by men whose conscience troubles them solely when their own interests are in jeopardy. The streams form their highways, and on them they depend for the transportation of logs from the place of cutting to the mill or market. During the dry seasons, the trees are felled and skidded, *i. e.*, rolled into piles with the bottom two or three set crosswise to form a sort of track whence they can be loaded on sleds or rolled into the channel of the stream. The wet season having arrived, it is here that the interests of the State and timber "jobbers" conflict; for the time when the freshets are relied upon to fill the reservoirs is the time when the lumbermen calculate to "run" their logs down the stream, depending on the large volume and furious rush of the water to carry them over obstacles which would be impassible during the ordinary or minimum stage of the stream.

Sand lake is repeatedly emptied for this purpose, as, indeed, are many others, and this water, passing down the river and over the dam at Forestport, benefits neither the mills nor the canals, but, to the contrary, defrauds them effectually of the water designed to carry them through the summer season.

The Bisby lakes are constantly tampered with, and it is a fact, well known among the inhabitants of the region, that vast quantities are so wasted, every year, when least needed.

Chub lake is another, and most serious, obstacle in the way of a proper regulation of the supply. This is one of the four lakes authorized to be dammed in 1855, but, in 1857, after an expenditure of some fourteen hundred dollars, on a part of the embankment for a dam, work was abandoned, and has never been resumed. There is a timber dam, however, at the foot of this lake, controlled and kept in repair by private parties. On reference to the accompanying map it will be seen that the entire flow of Woodhull, Sand, and the Bisby lakes passes through this one — when the gates are open — which is, whenever the owners see fit.

I have it on the authority of Superintendent Phillips, that, during the past season, when the water was most urgently needed for the canal, and Woodhull was being discharged to meet such wants, he found, on driving to Chub lake, the gates shut and the private pond filling at the expense of the State — and this, on two occasions within a week.

In this connection, I would call your attention to the accompanying sketch of this dam and the note thereon made with reference to the bulkhead gates.

On the Moose river system there are two dams; at the foot of First and of Sixth lake, respectively. That at the foot of First lake is the one known as the "Old Forge dam" and here a private saw mill utilizes the fall, and, apparently, controls the flow of water through the gates. This dam sets the water back over the first four lakes of the chain and these are navigated at present by two steamers, one small, and the other, recently built, of considerable size and draught, requiring nearly as much water as the present back-flow affords in channels between the lakes. The owners of these interests have a very natural tendency to withhold every drop of water they are not compelled to part with.

At Stillwater dam, on Beaver river, the drawing of the water lays bare large areas of ground, which, on hot days, generate most offensive and unhealthy gases, and, as well, contracts the channels and by-ways through which travel is facilitated for the summer pleasure seeker.

Amid these diverse interests it is a source of considerable surprise that the canal and river receive as much water in the dry season as they do. Possession has frequently been quoted as "nine points of the law" and, however this may be, the man in the woods has assuredly the best of the superintendent at Boonville, twenty or twenty-five miles away.

In the face of these facts, the difficulty of making even an approximate estimate of the actual quantities supplied by the reservoirs will be appreciated.

Many thousands of dollars have been expended in erecting them and it is incumbent upon the State to maintain them in a creditable manner. Their importance is unquestionable, especially in the face of such a situation as the present one, and it is exasperating to the last degree to be obliged to resort to-day to the same methods of estimate that would have been employed, were they yet unbuilt.

But, while it is comparatively easy to point out the defects in this system, there are many obstacles to encounter in overcoming them. It is impracticable to detail a man at each dam and support him there, but the present force should certainly be increased and a system of espionage established, by frequent inspection by responsible and disinterested men. Gauges should be set at every dam and systematic records kept of depths registered thereon and of every change in the position of gates or valves. With these data it would be a very simple matter to calculate, within a small percentage, the actual discharge during any period.

Situated as the lakes are, however, it would always be a matter of great difficulty, if not absolutely impossible, to control them satisfactorily and economically from such a distance, and no amount of improvement in the methods of communication can ever hasten the flow of water in its passage to the canal in time of sudden need.

There has been recommended annually, and with increasing urgency, for several years past, a remedy for all this delay, and in such a form as to carry conviction with it. I refer to the additional dam and reservoir proposed at Forestport, the construction of which was authorized by Act, Chapter 452, Laws of 1883, and $20,000 appropriated therefor, $35,000 less than the engineer's estimate. Fifteen thousand dollars was expended in getting out stone for the piers and in other preparations, including some considerable excavation for the bulkhead ; but no further appropriation being made, the work has been abandoned for four years. The original plan called for a dam twenty-one feet in height, but this was reduced later to fifteen feet. The flow-line of the fifteen-foot dam at this point incloses about 800 acres, as actually run out; but if built, the original height, at least, of twenty-one feet should be restored, as a very large proportion of the ground consists of flats, which would be but slightly flowed by a fifteen-foot dam, while a height of twenty-one feet, or even more, would increase the area of flow inconsiderably, in proportion to the great increase in capacity.

This reservoir, as shown on accompanying map, commences at the head of the present Forestport pond, some two miles from the entrance to the feeder. It would thus be immediately under the control of the superintendent. It is my opinion that a twenty-one-foot dam would afford a capacity of at least 350,000,000 cubic feet or twenty-one days full supply for the canals; and in this way, an economical, reliable and available supply afforded. This would require an additional appropriation of about fifty-five thousand dollars.

Act Chapter 336, Laws 1881, appropriated $6,000 for reservoirs on Beaver river and Independence creek; Act Chapter 362, Laws 1882, appropriated $6,000 additional; Act Chapter 551, Laws 1884, appropriated $6,000 additional; Act Chapter 330, Laws 1886, reappropriated $6,000 appropriated in 1881; $5,804.73 unexpended appropriation in 1882; $2,003.30 unexpended appropriation in 1884; and $1,000 newly appropriated—$14, 808,03.

Under this bill the Stillwater dam was erected on Beaver river, with an available height of nine feet one inch. It is a substantial structure of trees, and hewn cribs, about three hundred and fifty feet long. At present there exists a bad break in one end, which can, however, be repaired at no great expense. The flow-line has been partly run for this dam, or, rather, for a dam with a crest five feet higher, as was originally designed, and the area inclosed by the whole is estimated by Assistant Engineer C. E. Phelps, under whose charge the survey was made, at about three thousand acres.

From observations made in August last, and on the basis of the above total flow, I estimate the present capacity at 328,000,000 cubic feet, while every foot added to the height of the present dam will increase the present capacity 100,000,000 cubic feet or more.

Levels were also run by which it was determined that the dam could be raised ten, fifteen, or even twenty feet if desired without fear of flowing back into undesirable outlets.

Between Stillwater and the mouth at Castorland, on the Black river, there are no available sites for future reservoirs, nor, indeed, will they be required; for, as the Beaver river can only be utilized for the restoration of water diverted from the Black river, it is not so essential that immediate communication should be established with the supply, nor that the reservoir should be near the point of need.

This is by all means the most available spot for any increase in the present storage capacity of our reservoir system and, with its extensive water-shed, no doubts can be entertained as to its prompt filling in spring. Every consideration of economy, reliability, and facility in management would indicate as the wisest policy that which has for its ultimate view the abandonment of so many small, unessential and isolated reservoirs or, at least, their subordination to a few, large and readily controlled.

As above noted, the flow-line has been about half run out, at a height of five feet above the present crest, and this line is the boundary of the appropriation. To raise the dam these five feet would involve no increased damages and in fact, even a greater height would add but little area, as this line now traverses shores for the greater part bluff.

As estimated, a raise of five feet would give a total capacity of 850,000,000 cubic feet, or enough to afford 11,000 cubic feet per minute for about fifty-five days, nearly sufficient to compensate for water diverted by the canal. A rise of eight feet would increase the capacity to about 1,100,000,000, sufficient to supply 11,000 cubic feet per minute, for about sixty-nine days. To raise this dam five feet, would cost about $16,000, and to raise it eight feet would cost about $25,000.

Reconnaissances were also made of Smith's lake, nearer the head of Beaver river, where the opportunity exists for a reservoir of some 670,000,000 cubic feet, impounded by a dam eight feet in height and 300 feet long. Also, on the north branch of Moose river, two miles north of Old Forge, where a twenty-foot dam, 400 feet long, would set the water back to a depth of ten feet on First lake (Moose), with a probable capacity of 1,000,000,000 cubic feet or more, covering about 2,000 acres and supplied by a water-shed of about sixty square miles.

The Fulton chain, as has been stated by examining engineers, affords excellent advantages for a reservoir of a capacity far beyond any yet attempted, but there are grave doubts in my mind as to the sufficiency of the water-shed to feed one of such large capacity. There is, besides this, another important factor to be taken into consideration. The lakes are thickly populated in summer by cottagers, who have built within a few feet of the present water level, and any proposition to deprive them of this pleasure ground could not fail to elicit great opposition, not to mention the actual damage done to a beautiful country by conversion into a waste of deadened limbs and leafless brush.

The engineer in the past, when endeavoring to locate a suitable site for a reservoir, had many difficulties to contend with that do not exist for us. With increased familiarity with the wilderness, come more effective plans. In all probability many of the existing dams would never have been built had more intimate acquaintance with facts been possible. The old settlers' statements as to relative heights of streams and lakes, often carried with them more of conviction than of fact.

The question is presented, whether it is better to abide by the the decisions then made, or to be guided entirely by circumstances as now developed.

There are some thirteen reservoirs in the Black river system, two on the Moose, and one on the Beaver river — fifteen in all — with, as we have seen, an aggregate capacity of between two and three times the necessary water and still their object remains unaccomplished.

To achieve it satisfactorily, by merely improving them, would, I believe, be more expensive and less satisfactory than the following course, which is submitted in the hope that it will meet with your concurrence and approval.

I would recommend:

First. That Chub lake dam should at once be appropriated and either utilized in its present condition and a watchman stationed there, or, cut away entirely. At present, three days must elapse before water can be obtained at Boonville from the reservoir, and the situation is aggravated beyond endurance if there is further delay by its retention in this lake.

Second. That steps be taken to insure the making and recording of observations as heretofore suggested and, as well, the better guarding of reservoirs when filled.

Third. That Stillwater dam be raised five feet at once, and careful observations made thereat and recorded as heretofore recommended.

Fourth. That the Forestport dam be erected in a most substantial manner, as at first proposed, with a crest twenty-one feet above the surface of the water at the head of the present pond.

These last two recommendations being made with the idea of ultimately relying upon the Forestport dam (and the largest of the present reservoirs as storage auxiliaries), to supply any additional water called for by the Erie, and upon the Stillwater dam to make good the diversion created at Forestport.

Having adopted the above, data would be available whereby actual results can be accurately known.

If then the preceding estimates of available capacity are verified, to have gleaned the full benefit from the system in its present condition, would have entailed an outlay vastly greater than the establishment of the new Forestport reservoir and the raising of the Stillwater dam. The small outlying reservoirs could then be abandoned and the expense of their maintenance thus saved.

Or, if the estimates are shown to be materially too large the present system is inadequate and the increased storage obtained will then be proven a necessity.

Very respectfully submitted.

AUG. S. KIBBE,
Assistant-Engineer in charge.

REPORT

OF

ENGINEER IN CHARGE

OF THE

HUDSON RIVER IMPROVEMENT,

FOR THE YEAR 1888.

38

REPORT.

ALBANY, *December* 1, 1888.

HON. JOHN BOGART,
State Engineer and Surveyor :

SIR.—I have the honor to transmit herewith my report on the Hudson river improvement for the current year.

Yours respectfully.
MARTIN SCHENCK,
Assistant Engineer in charge.

By act chapter 173, of the Laws of 1888, there was appropriated the sum of fifty thousand (50,000) dollars for the purpose of removing obstructions in, and improving the navigation of, the Hudson river, from the city of Troy to the south line of the town of Coxsackie, by deepening and widening the navigable channel of said river so as to secure a channel eighty (80) feet wide and six (6) feet in depth of water at low tide, from the sloop-lock to the railroad bridge at Troy; one hundred and forty (140) feet wide and ten (10) feet deep at low tide, from the railroad bridge at Troy to the lower railroad bridge at Albany; and one hundred and seventy-five feet (175) wide and eleven (11) feet deep, from the lower railroad bridge at Albany to the south line of the town of Coxsackie.

This law is substantially in accordance with a recommendation made in the report for the year 1887. It gives an increase of $20,000 over the amount annually appropriated for several years past. The wisdom of such increase is shown by the marked better condition of the navigable channel, the general satisfaction expressed by navigators, and the almost entire absence of complaints from them.

The sum of $5,000 was set aside for necessary engineering expenses under the direction of the State Engineer and Surveyor, and the corps organized consisted of an engineer in charge, a leveler, four rodmen and a chainman. This corps began work on May 14, 1888, and continued without interruption up to the present time.

There have been no serious delays to navigation during the past season, owing, in part, to the fact that there were no bad ice-gorges in the river in the winter or spring of the present year. A preliminary survey revealed the fact that much of the work done last season still remained in good condition, hence we have been enabled, through these favorable circumstances and the increased appropriation for this year, to improve river navigation in a very marked degree.

On May seventeenth, reconnaissance sounding was begun at Finch's wharf, near the south line of the town of Coxsackie, and the channel of the river was carefully sounded up to the State dam at Troy, since which time surveys have been made and maps and notes filed in the office of the State Engineer and Surveyor, as shown by the following list:

Number and date of surveys made during the season of 1888:

1. Reconnaissance of channel, May seventeenth.
2. Bath shoals, May twenty-third.
3. Kellogg shoals, May twenty-fifth.
4. Van Buren bar, May twenty-eighth.
5. Washington bar, May twenty-ninth.
6. Upper railroad bridge, June first.
7. Fish-house shoals, June fourth.
8. Troy railroad bridge, June eighth.
9. Watervliet arsenal dock, June eleventh.
10. Stone-house bar, June thirteenth.
11. Upper side-cut, June fifteenth.
12. New Baltimore light, June nineteenth.
13. Mull's bar, June twenty-second.
14. Round shoals, June twenty-sixth.
15. Parda Hook bar, July sixth.
16. Coeymans west channel, July eleventh.
17. Bogart light, July twenty-fifth.
18. Lower railroad bridge, Albany, July twenty-eighth.
19. Nine-mile Tree, August ninth.
20. Overslaugh bar, August twenty-first.
21. Coxsackie light, August twenty-fifth.
22. Bear Island dyke, August twenty-eighth.
23. Stuyvesant channel, September fourth.

Final surveys were also made at the following points;

24. Stone-house bar.
25. New Baltimore light.
26. Bath shoals.
27. Kellogg shoals.

28. Fish-house shoals.
29. Troy railroad bridge.
30. Arsenal dock.
31. Mull's bar.
32. Nine-mile tree.
33. Parda Hook.

The above includes all work completed in time to make final estimates before the river corps was disbanded.

Surveys or soundings were also made at all dump grounds where any material was dumped outside of any dyke or dock, to be afterwards thrown over, and in all cases the contractor has been required to restore the water to its original depth, as shown by such survey or soundings.

At the date of the first letting the prices bid for work being considered excessive, the bids were thrown out by the Superintendent of Public Works, and the work was readvertised. This, although very advantageous to the State, delayed dredging operations somewhat, but with this exception the work has been prosecuted constantly, and from four to nine dredges have been employed up to the end of the season.

TABLE SHOWING THE DATES AND LOCATIONS OF SURVEYS, ENGINEER'S ESTIMATES, CONTRACT PRICES, QUANTITIES DREDGED, ETC.

Date of survey.	LOCATION OF SHOAL.	Engineer's estimate	Date of letting.	By whom done.	Contract price.	Material removed.	Date when completed.	Amount of final payment.	Remarks.
		Cu. yds.			Cents.	Cu. yds.			
May 23	Bath shoals	3,000	July 10	Lane & Brumelkamp	25	3,230	Sept. 20	$807 50	
May 25	Kellogg shoals	7,000	July 10	Lane & Brumelkamp	25	7,680	Sept. 17	1,920 00	
May 28	Van Buren bar	10,000	July 10	Lane & Brumelkamp	25	5,018	....	1,254 50	Not completed for lack of money.
May 29	Washington bar	6,000	July 10	Lane & Brumelkamp	25	6,006	Nov. 16	1,501 50	
June 1	Upper railroad bridge	1,000	....	Supt. of Public Works	....	1,188	July 19	222 00	Actual cost of labor.
June 4	Fish-house shoals	12,000	July 10	Lane & Brumelkamp	25	13,215	July 21	3,303 75	
June 8	Troy railroad bridge	11,000	July 31	P. W. Myres	38	10,955.5	July 21	4,163 09	
June 11	Arsenal dock	14,000	July 31	Lane & Brumelkamp	35	14,029.6	Nov. 1	4,910 36	
June 13	Stone-house bar	6,000	July 13	P. W. Myres	16½	6,032.75	Aug. 14	995 40	
June 15	Upper side-cut	3,000	....	Supt. of Public Works	....	3,968	Aug. 1	533 20	Actual cost of labor.
June 19	New Baltimore light	18,000	July 13	P. W. Myres	14	18,089.7	Aug. 30	2,532 55	
June 22	Mull's light	25,000	July 13	E. M. Payn	15 9-10	25,224.75	Sept. 15	4,010 73	
June 26	Round shoals	17,000	July 31	Lane & Brumelkamp	24 9-10	15,303	Nov. 30	3,810 45	
July 6	Parda hook	20,000	July 13	P. W. Myres	15½	19,665.6	Oct. 13	3,048 16	
July 11	Coeymans	9,000	....	....	....	....	....	....	Work not done; no funds.
July 25	Bogart light	9,000	July 31	E. M. Payn	16⅞	9,176.7	Sept. 20	1,548 57	
July 28	Lower railroad bridge	6,000	....	Supt. of Public Works	....	6,514	Aug. 25	738 87	Actual cost of labor.
Aug. 9	Nine-mile tree	7,000	Sept. 11	P. W. Myres	16	7,017.5	Sept. 27	1,122 80	
Aug. 21	Overslaugh bar	23,000	Sept. 11	E. M. Payn	17⅜	23,100	Nov. 14	4,013 25	

Total 195,414.1

While the general condition of the river channel has for the past season been very good, and those best qualified to know report a steady and marked improvement during the past half-dozen years, due in part to a very careful supervision of dredging operations, still there is room for much improvement in the manner of disposing of the dredged material.

There are no good dump grounds north of Mull's Light, *i. e.*, places where material can be dumped back of dykes direct from the scows; hence the custom has prevailed of dumping along and outside of the dykes, and throwing the material over the dyke afterward. This is the practice to a very great extent by contractors on work other than State work, where there is no supervision by any State or government authority, and much of this dredged material from these private jobs is either left in the river entirely or thrown upon (not over) the dyke and allowed to wash back into the stream.

This manner of disposing of material is a very pernicious practice, especially when these dumping places are located near the river channel, for even if an attempt is made to redredge and throw the material over the dyke, a large percentage of it will be found to have disappeared, having been drawn into the channel by the passage of steamboats. As before stated whenever any material from State jobs has been dumped in this way, careful soundings were first taken and the contractor required to restore the original depth. This, however, is but a partial remedy and in the future any depositing of material outside of dykes should be prohibited. It is to be hoped that some system will be in the near future devised and enforced that will remedy this evil.

In recent acts of the Legislature appropriating moneys for the improvement of the Hudson river, the width and depth of the channel are specified; hence I would respectfully call your attention to a few existing obstructions to navigation which do not seem to come within the letter of these laws.

First. At the mouth of Schodack creek a sand-spit extends into the channel in such a manner as to be somewhat of an obstruction to navigation at this point, and although the channel here has much more than the required width, the sand-spit extends into it so that long tows are frequently caught upon it. Hence the removal of part of this spit is respectfully recommended. The probable cost of this would not exceed six hundred (600) dollars.

Second. At and immediately north of Mull's light for several years past large quantities of sand have been dredged, but each succeeding year finds nearly the same quantity of deposit, and the upper end of the channel over the bar gradually working over to the eastward. This is due to the fact that a large sand-bar is being cut away by the action of the spring freshets and deposited as before stated. This bar is located between Mull's light and Nine-mile tree, so as to form an angle in the channel. Its removal would straighten the channel between these points, reduce the number of cross-overs and obviate the necessity for frequent dredgings at Mull's bar. For these reasons this improvement, the estimated cost of which is about six thousand dollars, is recommended.

While dredging the bar at Overslaugh dyke during the season of 1884, it was found that a reef or rock prevented the securing of the required depth of water, which fact was reported by the Superintendent of Public Works to the United States Engineer Department. In the report of the war department for the year 1885, it was stated that a survey had been made, the rock located, and an estimate made to to remove this obstruction. This reef, however, still remains a serious menace to navigation, and should be removed at once. In our dredging operations at this point the past season, a bend was put in the channel so as to avoid the rock as much as possible. This, however, is but a temporary makeshift, and will, from its location probably fill up during the coming winter.

It would be impossible to construct a properly shaped channel so as to avoid this reef without a large outlay of money. Nothing having been done by the United States authorities up to this date towards removing this rock, it would seem proper that their attention be called to it again, and in the event of their failure or neglect to do so, an effort should be made to have the Legislature of 1889 appropriate money to remove it at once, since deepening the channel by dredging at this point has increased the dangers to deep-draught vessels, especially to deep-draught propellers.

About 300 feet north of Bogart light a break exists in the government dyke, which break at seasons of high water forms one of the outlets for the water of the Normanskill, thus producing a counter current in the river at this point, and causing large quantities of sand to deposit, which has to be removed nearly every year, and it would, therefore, be far less expensive for the State to close this break at once. It would be well at the same time to raise about 500 feet of the dyke at this place, so as to conform with the height of the Overslaugh dyke adjoining, and prevent overflows at seasons of high water.

Quite a large amount of dredging is required to put the channel between the State dam and the railroad bridge at Troy in good shape, so as to comply with the requirements of the improvement act; nothing has been done however, on account of lack of funds to complete the work if undertaken.

The State dykes with one exception (that being the dyke one mile south of Castleton) are in a very good state of repairs and all seem to well subserve the use for which they were constructed. The dyke at Castleton needs refilling in several places and a few wale pieces and tie rods require renewing. Small quantities of stone filling are required in the other State dykes in several places, making a total of about 5,000 cubic yards to be placed as follows : One thousand cubic yards at New Baltimore, 1,500 cubic yards at Mull's Light, and 2,500 cubic yards at Castleton. This work ought to be done during the season of 1889, or before the dykes become further injured by ice, which will surely occur unless the dykes are kept well filled.

As per the Hudson river improvement act, the channel this season has been given a depth of ten (10) feet and a width of one hundred and forty (140) feet, between Troy and Albany; and a depth of eleven (11) feet and a width of one hundred and seventy-five (175) feet, from Albany south. This, with the exception of the width of channel below Albany, is substantially as recommended in the report for 1887. I would respectfully renew my recommendation for a channel between Albany and Troy having a width and depth as above, and south of Albany a depth of eleven (11) feet at mean low tide, and a width of two hundred (200) feet. This can be easily maintained with (or after a year or two with less than) the amount appropriated for the present year, and the enormous traffic on the Hudson river would seem to fully warrant such a channel as recommended.

The contract prices for dredging this season have been at fair living rates, the work generally has been performed in a very satisfactory manner, and we have been enabled to cover nearly all the ground contemplated by the Hudson river improvement law. It is believed that much of the channel recently dredged to the increased depth required by this law, will remain in good shape for some years to come, and that a portion of the next appropriation, if any is made, can be devoted to completing the improvement to the channel as contemplated, and making the necessary repairs to State dykes. The low rates for dredging during the seasons of 1885, 1886 and 1887 have not prevailed this season, nor are they likely to in the near future, hence it would seem that the appropriation for the coming year ought to be as large as that of the present.

In my report for the year 1887, attention was called to the dilapidated condition of the United States government dykes, especially those between Troy and Albany. Nothing has been done since the date of that report toward making any repairs to these dykes, although there is an item in the last river and harbor improvement bill, making provision for some improvements in the Hudson river, and it is hoped that part at least of this appropriation may be devoted to dyke repairs.

With good dykes it would be neither difficult nor expensive to maintain ten (10) feet of water at mean low tide between this city and Troy, and I would therefore renew my recommendation that the Legislature for the coming year, be asked to call the attention of Congress to the condition of these dykes and secure, if possible, their much needed repairs.

As before stated, one of the crying evils of our river improvement system, is the present expensive and insufficient method of disposing of the material dredged from the river channel; it is therefore earnestly recommended that the State purchase, as soon as practical, some sort of plant, which will handle and dispose of this material cheaply and in such a manner and place that the same shall not find its way back into the channel of the river. With good dykes and a proper method of disposing of material dredged from the shoals, the problem of excellent navigation in the Hudson river is one of easy solution.

In closing this report it affords me pleasure to call your attention to a few facts connected with the improvement of the Hudson river for the past two seasons. During the first few months of the season of 1887, two deep-draught propellers owned by one of the towing companies in this city, broke several screw wheels, and were also frequently detained on bars until high tide, but since that time no breakage of wheels, nor a single hours detention to steamers have occurred between Coxsackie and Albany. During the early portion of last season, complaints by navigators and newspapers, regarding the condition of the river channel were very frequent, but since that time, and up to the present, there has been an entire absence of complaints from these sources. Vessels that a few years since were obliged to await high water in order to get to Troy from Albany, have had no difficulty in doing so at any stage of the water this season. Such marked evidences of improvement are certainly very gratifying to all interested in the navigation of the Hudson river, as well as complimentary to all connected with its improvement.

The following table shows amount of disbursements by this department for the year:

STATEMENT OF DISBURSEMENTS BY THE ENGINEERING DEPARTMENT OF THE HUDSON RIVER IMPROVEMENT FOR THE YEAR 1888.

MONTH.	Salaries.	Hotel and travel.	Office expenses, including office rent.	Labor and material.	Telegraph, telephone and postage.	Boat hire.	Total per month.
May	$378 00	$15 68	$35 57	$9 35	....	$45 50	$484 10
June	702 00	45 40	22 12	1 00	$0 70	66 50	837 72
July	688 00	25 70	18 07	74	75	49 00	782 26
August	729 00	26 40	16 67	60	1 36	49 00	823 03
September	675 00	18 80	23 57	52	....	45 50	763 39
October	729 00	12 38	23 67	05	41	7 00	772 51
November	509 50	1 54	16 67	....	....	....	527 71
Total	$4,410 50	$145 90	$156 34	$12 26	$3 22	$262 50	$4,990 72

LOCATION, LENGTH, DESCRIPTION, ETC., OF DYKES ON THE HUDSON RIVER BETWEEN TROY AND NEW BALTIMORE.

Port Schuyler dyke, located at Port Schuyler, on the west side of the river, is in part a raised, paved mole and the balance paved shore dyke; was built by the United States government in 1836–37; was repaired in 1866, and is 4,795 feet in length.

Hillhouse island dyke, located three miles north of Albany,* on the west side of the river, is a paved shore dyke, built by the United States government in 1836; was repaired in 1867, and is 2,168 feet in length.

Base island dyke, built by the United States government in 1870, is a crib dyke, located on the east side of the river, three miles north of Albany, and is 5,834 feet in length.

High dyke, located two and one-half miles north of Albany, on the west side of the river, is a double-pile dyke, built by the United States government in 1867; was raised to a height of six feet above mean high water mark in 1874, and is 2,927 feet in length.

Fish house dyke, built by the United States government in 1873, '74 and '77, is a double-pile dyke, located on the east side of the river, two miles north of Albany, and has a length of 3,295 feet.

Pleasure island dyke is a paved shore dyke, located on the west side of the river two miles north of Albany; was built by the United States government in 1839, and is 2,293 feet in length.

Patroon's lower island dyke, built by the United States government in 1870, is a double-pile dyke, located on the west side of the river, one and one-half miles north of Albany, and has a length of 3,420 feet.

Immediately south of the last-named dyke, a single-pile dyke; was built by the United States government in 1876; was 2,200 feet in length, nearly all of which has been destroyed by the ice.

Bath dyke located on the east side of the river one mile north of Albany, is a double-pile dyke built by the United States government in 1870, and is 3,586 feet long.

The foregoing comprise all dykes between Troy and Albany, and all of them are more or less in need of repairs.

Greenbush dyke located on the east side of the river, one-half mile south of Albany is a double-pile dyke 3,086 feet in length, and was built by the State of New York in 1865 and 1866.

From the Jagger Iron Works in the south part of Albany to Bogart island, a double-pile dyke was built on the west side of the river by the United States government in 1873 and 1874, and has a length of 5,200 feet.

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* All distances mean from Steamboat square.

Douw's Point dyke on the east side of the river one and one-half miles south of Albany, is a double-pile dyke, 4,880 feet in length and was built by the United States government in 1868.

Bogart's island dyke, built by the United States government in 1866, is part pile shore dyke and the balance double-pile dyke, is 2,502 feet in length and is located on the west side of the river, two miles south of Albany.

Papscanee dyke, built by the United States government in three sections as follows: Section 1, 1876 and 1877; section 2, in 1877; section 3, 1877, is located on the east side of the river, two and one-half miles south of Albany and the combined length of the three sections is 10,666 feet.

Overslaugh dyke, upper section located north of the Abbey entrance two and one-half miles south of Albany, on the west side of the river, is a paved mole dyke with pile facing, built by the United States government in 1835, 1836 and 1837, and repaired in 1866, and is 4,190 feet in length. This is one of the most important and useful dykes on the river and is said to have cost sixty dollars per lineal foot.

Abbey entrance-dyke, on the west side of the river, is a double-pile dyke built by the United States government, in 1866, is 1,503 feet in length, and connects the upper and lower sections of the Overslaugh dyke.

Lower Overslaugh dyke, on west side of the river, three miles and a half south of Albany, is constructed like the Upper Overslaugh dyke, and was built by the United State government, in 1837, 1838 and 1839; was repaired in 1867 and 1868, and is 4,212 feet in length.

Stone-light dyke, located on the west side of the river, four miles south of Albany, is a double-pile dyke, built by the United States government, in 1867, and is 601 feet in length.

Bear island single-pile dyke, built by the United States government, in 1877, is 1,460 feet in length, and is located on the west side of the river, five miles south of Albany.

Winnie's dyke, located on the west side of the river, five and one-half miles south of Albany, is a double-pile dyke, built by the United States government, in 1869, and is 2,920 feet in length.

Pixtaway island dyke, built by the State of New York, in 1863 and 1864, is located on the east side of the river, five and one-half miles south of Albany, is 2,907 feet in length, the greatest part of which is double-pile and the balance pile-shore dyke.

A single-pile dyke was built, by the United States government, on the east side of the river channel, and was located outside, and about 500 feet distant from the last-named dyke, in 1871. This dyke, as originally built, was 5,709 feet in length, but, at present, only about one-half of it remains, the balance having been carried away by the ice.

Campbell's island dyke, located on the east side of the river, six and one-half miles south of Albany, is a double-pile dyke, built by the United States government, in 1868, is 1835 feet in length.

Cow island dyke, built by the United States government in 1868, is located on the east side of the river, seven miles south of Albany, is part shore and balance double-pile dyke, and is 3,795 feet in length.

Cedar hill dyke, on the west side of the river at Cedar hill, was built by the United States government in 1868, is 4,362 feet in length, and is a double-pile dyke, except a small portion of single-pile at north end.

Between Poplar and Schemerhorn islands, on the west side of the river, seven and one-half miles south of Albany, is a double-pile dyke, built by the United States government in 1873, and is 3,170 feet in length.

Immediately south of Castleton, on the east side of the river, is a dyke built by the United States government in 1869 and 1870, a small portion of which is double-pile, and the balance pile-shore dyke, 2,168 feet in length.

The dyke known as Castleton light dyke, extends from a point 1,200 feet north of Castleton light, southward to Nine-mile tree, which last point is distant nine miles from the Steamboat square at Albany. This dyke was built by the State of New York in 1863 and 1864; is located on the east side of the river, and is a double-pile dyke 2,960 feet in length.

Immediately south of Nine-mile tree, on the east side of the river, is a dyke 710 feet in length, built by the United States government in 1869 and 1870, and is all double-pile dyke, except a small portion of shore dyke at the south end.

On the east side of the river, north of Hellegat, nine and one-half miles south of Albany, is located a piece of pile-shore dyke 876 feet in length, built by the United States government in 1869 and 1870.

Mulls light dyke, located on the east side of the river, ten miles south of Albany, was built by the State of New York in 1866 and 1867, and extended southward in 1872, is a double-pile dyke, 3,628 feet in length.

Shad island dykes, built by the United States government in 1871, are located on the west side of the river, ten miles south of Albany;

are single pile dykes, and were 9,250 feet in length, but a large portion of this length has been carried away by the ice.

Roah Hook dyke, built by the United States government in 1869, is a double-pile dyke, located on the west side of the river about eleven and one-half miles south of Albany, is 1,835 feet in length, and runs northward from Roah Hook light.

Coeymans dyke, located on the west side of the river, immediately north of the dock at Coeymans, is a double-pile dyke, built by the United States government in 1871 and 1872, and has a length of 2,085 feet.

Coeymans middle-ground dyke, located on the middle ground, Coeymans, twelve miles south of Albany, is a double-pile dyke, built by the United States government in 1871 and 1872, extended southward in 1877, was repaired in 1887 and 1888, and is 2,910 feet in length.

Baeren island dyke, on the west side of the river, extends from the dock at Coeymans southward to the north end of Baeren island, is a double-pile dyke built by the United States government in 1871 and 1872, and has a length of 1,580 feet.

Between the south end of Mull's plaat and Coeymans east light, on the east side of the river, eleven and one-half miles south of Albany, is a double-pile dyke, built by the State of New York in 1863 and 1864 and is 2,710 feet in length.

South of Coeymans east light, on the east side of the river, is a pile shore dyke built by the United States government in 1868 and 1869. This dyke is located twelve miles south of Albany, and has a length of 4,170 feet.

New Baltimore west dyke, located on the west side of the river, fourteen miles south of Albany, is a double-pile dyke built by the United States government in 1875 and 1876; was repaired in 1886 and 1887 and is 3,794 feet in length.

New Baltimore dyke, located on east side of the river and opposite New Baltimore, is a double-pile dyke, built by the State of New York in 1866 and 1867; extended southward in 1885 and 1886; repaired in 1882, 1883, 1886 and 1887, and is 6,470 feet in length.

The foregoing list includes all dykes between Troy and New Baltimore and all dykes of the upper Hudson system. As stated in the body of this report the State dykes are in a very fair state of repair generally, but all of the government dykes, except the New Baltimore west dyke and the Coeymans middle-ground dyke, require extensive repairs.